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BOTANIC GARDENS DEPARTMENT,
STRAITS SETTLEMENTS.

AGRICULTURAL BULLETIN
OF THE
MALAY PENINSULA.

No. 8.] DECEMBER. [1898.

425

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SINGAPORE:
PRINTED FOR THE BOTANIC GARDENS DEPARTMENT,
AT THE
GOVERNMENT PRINTING OFFICE.

To be purchased at the Botanic Gardens, Singapore; or from
Messrs. KELLY AND WALSH, LIMITED.

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VEGETABLES.

From a hygienic point of view, the use of vegetables in the Straits is generally very much neglected. Few persons ever cultivate any at all, but restrict themselves to a few imported kinds and a small number of native ones often very inferior in quality. Attempts have been made, both in Penang and Singapore, by supplying seed of suitable English kinds free of cost to some of the Chinese market gardeners, to induce them to cultivate these vegetables regularly, but without much success. This is partly due to the Chinese disinclination to take up anything new, and also to the fact that there are comparatively few customers who are prepared to pay a good price for good vegetables; and this not only deters the gardeners from cultivating newly-introduced vegetables, but prevents any material improvement in native kinds. Many native vegetables, partly wild as they are, are far superior to the original wild forms of the best European kind, but, as beyond a certain point, there has been no attempt to improve them by selection and competition, they are still very little altered from their original wild forms.

Of late years, however, the chocho has become quite common in Penang markets, and locally cultivated tomatoes, green peas and artichokes have appeared in the Singapore markets, but only very fitfully. A good many vegetables can be grown on the hills, which are utter failures on the plains, where several of the tuberous kinds, such as turnips, kohl rabi, beet and potatoes, run entirely to leaf and do not produce anything eatable at all. Mr CURTIS, after several years' experience in growing vegetables on a small scale on Penang Hill at an altitude of 2,500 feet, and trying pretty well everything that had a probable chance of succeeding, came to the conclusion that the kinds which could be grown there with a reasonable amount of care and expense w [illegible] chokes, asparagus, beet, cabbage, carrots, celery, c [illegible] chocho, endive, kohl rabi, lettuce, leeks, tomatoes an [illegible] with most of the pot herbs, such as mint and thyme. Th [illegible] on the top of Penang Hill is, however, limited, and the expense of carriage of manure, etc., to the garden from the foot of the hill are very large, but it may be hoped that when this and other hills of the Peninsula are made more accessible, we may be able to increase considerably the cultivation and use of European vegetables.

In the plains, a certain unmber of the European vegetables can be grown with success, and there are also a large number of native vegetables, many of which, excellent when well cooked are hardly known at all to Europeans, who seem quite content with imported potatoes and tomatoes, and native spinach, lablab beans, brinjals and okra, in fact with the cheapest and easiest things the cook can get. The importance of good and varied vegetables in a hot climate cannot be over-rated, and there is no reason why there should not be a more varied display on the tables of private houses.

CHOICE OF SITE.

In choosing a site for a vegetable garden, an open sunny spot, well removed from the shade, drip and roots of trees, is indispensable. A rich well-drained soil is also desirable, but is not so important as the absence of trees, as these are matters that can, to a certain extent, be remedied by the application of manure and labour. An easterly aspect is also the one to be preferred when there is any choice in the matter, as is often the case, especially on the hills, where the bungalow is generally built on the crest.

MANURE.

Farm-yard manure when obtainable is best for nearly all vegetables, and if well decayed can hardly be applied too freely. On the hills, unless cattle are kept, there is always a difficulty in obtaining enough, on account of the cost of transport, but on the plains this does not apply. Artificial manures such as guano, bone dust, and decayed prawns may be used to great advantage, either in a liquid form during dry weather, or worked in among the crops during showery weather.

ROTATION OF CROPS.

Two successive crops of the same kind of vegetable should never be grown on the same ground. For instance, onions should be grown on ground that had been previously planted with peas or potatoes, and so on.

SEASON FOR PLANTING.

The most favourable season for planting is the months in which there is least rain, and this varies in localities no great distance apart. In Penang November to February are generally the driest months, and the principal sowing is made towards the end of November. Subsequent sowings are made up to the end of February, and a few things, such as carrots, leeks, lettuce, maize and cabbages, may be grown all the year round, if protection from heavy rain is given to the seeds and young plants during the earlier stages of their growth.

SOWING SEEDS.

All small seeds, whether sown in boxes or beds, should be covered with a layer of rather light fine soil, varying in thickness according to the size of the seeds, in order that the young seedlings may readily find their way through it. In most cases they will also require, except during the most favourable weather, some protection during the first ten days or a fortnight from heavy rain. The covering of attaps, or whatever is used, must be movable so that it can be put on or taken off quickly, and on no account be kept on longer than is absolutely necessary. This is a most important point. If the seedlings are kept covered too long, they become drawn and weak, and no after attention will render the crop of much value. Too much stress cannot be laid on the fact that in this climate, owing to the very heavy rainfall, special care is necessary with seedlings of most plants during the earlier stages of growth. In the case of quick-growing things like vegetables this only extends over a few days, but any one not prepared to take the necessary precaution during that short time, should only plant during the dry season, and even then there is always a chance of heavy rain.

As it is much easier to protect seeds sown in boxes than when sown in beds, we adopt this method for a good many things, but great care must be taken that the boxes are exposed to plenty of sunlight to prevent drawing Lettuce, beet, celery, cabbages and some others, do well raised this way, and transplanted in beds as soon as they are big enough to handle. Some other things, such as carrots for instance, cannot be transplanted with success, as they never make a good root afterwards.

TRANSPLANTING.

The beds having been previously prepared, transplanting should, if possible, be done in the evening, and unless the weather is dull, the young plants will require shading for an hour or two in the middle of the day for the first few days. If the weather is dry, attention must be paid to watering in the morning or evening, or both if necessary, but avoid watering in the middle of the day.

INSECT-PESTS.

Insects of many kinds are very destructive to vegetables. I remember one instance, in which bed after bed of English beans and peas was utterly destroyed, as the plants were setting fruit by small maggots of some fly, not unlike the destructive celery fly of England. I attempted to rear the insect to identify it, but failed, nor was I able to stay the destruction. The maggots bored up the stems from the base near the roots, and the plants quickly withered and died. I never saw another case of it, and suspected that the insect was accidently imported with the seed,

Blight (*Cocci*) often appears in wet spots, and should be destroyed by tobacco-water or tuba. The large brown crickets are very destructive to young plants, especially to seedlings just above the ground. I have known a whole bed of pumpkin seedlings mown down by the jaws of these animals in a single night. These animals are almost all nocturnal in their habits, concealing themselves in long grass or rubbish during the day. It is advisable, therefore, to keep the ground near the vegetable garden clear of thick grass and weeds, and to destroy all piles of rubbish decaying sticks and leaves, and such like. The mole cricket which burrows in the ground and bites through the roots of plants of all kinds is very harmful. It can usually be detected by the piercing whirring noise it makes as it sits in the mouth of its hole in the evening, and can be dug out. Tomatoes are apt to be destroyed by the common red milleped, which appears to bite through the roots. They are also very liable to the well-known tomato disease, a fungus known as *Peronospora*. Caterpillars and small beetles, also often attack many vegetables, biting holes in the leaves, especially of the pumpkins and gourds.

Some species of ants are also very troublesome in carrying away the smaller seeds to their nests where they eat them.

For caterpillars and blight, the most easily obtained insecticide is tuba water, which is much used by the Chinese gardeners. The roots of the tuba plant (*Derris elliptica*) can be bought in the markets. They are pounded in water, till it becomes milky in appearance, and the decoction is sprinkled over the plants. It must be remembered that tuba is poisonous, and should not be applied to any vegetable for some days previous to its being required for the table. Tobacco water and soft soap, or phenyl dissolved in water till of the appearance of good milk, are probably the best insecticides for blight or aphides, the latter insects, however, are not very common here.

For a good portion of this paper, especially with the portions dealing with the European vegetables, I am indebted to Mr. CURTIS, who has for many years cultivated English vegetables on Penang Hill, at an altitude of 2,000 feet.

HERBS.

But few of the well-known English herbs are cultivated here, although it would be possible to grow many of them.

Parsley.—Is always in demand. It is readily grown from seed in boxes of earth, but as it never seems to produce seed here, it is necessary to import the seed for each cultivation, though it will last for some years if carefully treated. It is grown in boxes.

Rue.—Is often grown by the Chinese, usually in pots, as a curiosity or as a medicine. It is readily grown from cuttings, but seems to have almost died out as a seasoning herb in Europe, though formerly very popular.

Sweet Basil, "Selasih," Ocymum basilicum.—A small shrub with very sweetly scented leaves and white flowers, which is often cultivated by natives and used as medicine, for scenting clothes, etc. It grows very readily from seed, and forms a pretty, sweetly aromatic bush. Basil is a popular herb on the Continent as a seasoning herb, and there are a number of cultivated varieties grown in France.

Mint and *Thyme.*—Are easily raised from seed, and the former is often cultivated by the Chinese in Singapore. Thyme is less successful in the plains than on the hills.

Coleus aromaticus.—A fleshy, rather large-leaved, aromatic herb, with oval, green serrated leaves, readily cultivated from cuttings. The leaves are used for flavouring claret and other cups, and sometimes, instead of mint, for mint sauce.

SALAD HERBS.

A good number of these can readily be grown here, and as the importance of fresh green vegetables, especially in the tropics, is great, it is very remarkable that so little attention has been paid to these.

Water-cress.—Is raised from cuttings and can be grown in boxes, or in damp spots near water. If grown in water it is apt to become coarse. It is of very rapid growth, and for this reason alone, should be one of the most common salad plants in the country. It is, however, very rarely seen now in European houses. Cuttings are planted in damp black soil, or small ditches may be dug in low-lying spots, and the cress planted along the sides. It requires no manure. As grown here, the leaves are often rather small, and though larger plants can be grown by increasing the water-supply, the flavour is apt to be too pungent and coarse.

It can be used either as a salad herb, or as a spinach by boiling, and makes an excellent dish in this way.

French Sorrel.—Has been cultivated successfully here, and very good samples have been exhibited at the local Flower Shows. It is a salad herb seldom used in England, but popular in France, where it is generally eaten boiled. It makes an excellent addition to a salad in small quantities.

Endive.—Is as easily grown as lettuce, and forms an important addition to salads. The seeds may be sown in beds or boxes of light soil, and afterwards transplanted at about nine inches apart. As soon as they are full grown, they should be tied up to make them crisp. Green curled and Batavian are the two best varieties.

Kohl Rabi, or *Knol Kohl.*—Comes between the cabbage and turnip, is a fairly good substitute for the latter, and grows much better. Good soil that has been well manured for a previous crop suits it best, and liquid manure twice a week during dry weather. Seeds may be sown either in beds or boxes, and the young plants transplanted when about two inches high, at about nine inches apart. In favourable weather they are fit for use in about ten or eleven weeks, and should be used before they get too old. The best varieties are the Green Vienna and Purple Vienna. It can only be grown successfully on the hills at a height of 1,000 feet and upwards.

Lettuce.—With a little care and attention, lettuce may be had in season all the year. To attain this, frequent sowings must be made, say every fortnight. It is useless sowing a great quantity of seed at one time for if the crop is not used up quickly it is wasted. Lettuces transplant well, and a pinch of seed sown in a box or large pot every fortnight or three weeks, and pricked out as soon as large enough to handle, at about eight or ten inches apart, will keep up a regular supply for any ordinary household. They are generally ready to plant out in the beds in about fourteen days, and for use in about seven or eight weeks. A light, rich, deep soil, and liquid manure twice a week if the weather is dry, is what they require. The Cos lettuces do not thrive so well as the cabbage, and of the latter there is none equal to Tom

Thumb. The Chinese in Singapore cultivate a common kind of lettuce very extensively, but their habit of using night-soil for manuring makes it, as well as all other ground vegetables which are eaten uncooked, somewhat dangerous to eat.

Mustard and *Cress*.—Can be grown by any one, whether they have a garden or not. There are several ways of doing it, but one of the simplest is to put two or three inches of moss, cocoanut fibre or anything that will hold moisture, in a shallow box and make it thoroughly wet. On the top of this lay smoothly a piece of clean flannel, and on this sow the seeds thickly. Do not allow the flannel to get dry, and in three or four days the mustard and cress will be ready for use.

Mustard is also grown by the Chinese for the leaves, which they eat cooked. Unlike most European vegetables, it will sometimes produce perfectly good seed here.

Dandelion (*Taraxacum*).—Is also a very excellent salad plant, either alone or mixed with others. It is grown from seed, and pricked out like lettuce. In Europe, several forms are cultivated and usually they are improved by blanching, and though it appears impossible to blanch it properly here, it is well worth cultivating.

Chicory.—Can be grown in the same way, and is an excellent addition to a salad. Like dandelion, it is much improved in Europe by blanching, but even unblanched it is excellent.

Lamb's Lettuce or *Corn Salad*.—Can also be grown here, but seems rather more delicate, and liable to injury by heavy rain.

Pegaga (*Hydrocotyle asiatica*).—A common weed with rounded leaves, growing on banks and in grass, and much sought by natives as a medicinal herb, may be added to salad. It has a somewhat peculiar flavour, which, however, is not unpleasant, and it is very wholesome as a digestive.

Celery.—Although celery cannot be grown white and crisp here, it is most useful for flavouring, and is well worth attention. Sow the seeds in boxes or pots, and when big enough, plant them in beds or trenches that have been previously heavily manured, at about nine inches apart, cow manure, bone dust, and burnt earth may be applied liberally and, during dry weather, liquid manure. When about a foot high, the earth should be drawn up round the stems and again later on, but care must be taken not to cover the heart of the plants. A little shade during the middle of the day is beneficial.

Celery can be readily grown in this way both in the hills and plains, and very good samples are often to be seen at our Flower Shows. It is generally used for flavouring soups.

Beet.—Can only be grown with success in the hills. It is rarely of any use if grown in the plains. It requires rather a rich, light soil, which has been well manured for a previous crop. The seeds should be sown in drills about nine inches apart, and, as soon as strong enough, the plants thinned out to about six inches apart

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in the rows. They may also be sown in boxes and transplanted to beds when about an inch tall. In fact, this is the better plan when the rains are heavy. In England, the transplanting of beet is not generally recommended, but in this country it succeeds very well. An occasional watering with liquid, bone or fish manure during dry weather, hastens the crop, which is fit for use in from two-and-a-half to three months from the time of sowing. Egyptian, Turnip-rooted, Pragnell's Exhibition and Othello are the best varieties.

Radish.—English radishes are worth growing on account of the superiority of their flavour to that of the common Chinese kind, although they have a tendency to become woody very speedily. They grow much better in the hills than on the plains. "Frequent sowings of radish are necessary, as they remain only a short time in condition and require to be used up quickly. They require rather light, rich soil and, in dry weather, daily watering. When ten days or a fortnight old, a little guano or bone dust may be added to the water, or stirred in among the plants with a pointed stick, for the quicker they are grown the more crisp they will be. The seeds should be sown thinly, broadcast on beds previously prepared by digging and manuring, and covered with a little light soil. Turnip-radishes are better than the long kinds, and are ready for use in about a month from the time of sowing. Sow at intervals of about fourteen days from November to February," (C. C.)

Chinese radishes are easily grown from seed and are extensively planted in Singapore. They are white and oblong in shape, rather woody, and pungent and rather coarse in flavour. They can be eaten raw, but they are often cooked, when they somewhat resemble the turnip in flavour, though inferior to that vegetable.

Horse-radish tree "Morungei" (Moringa pterygosperma).—A small tree with finely-cut foliage and white flowers, followed by long, bean-like pods. The roots are used here in place of horse-radish, which in flavour they somewhat resemble, and the fruit is boiled and eaten either plain or curried, and is very popular with those who know it. The plant is raised from cuttings which are always taken from the woody branches about half-an-inch through and two or three feet tall. Smaller cuttings are rarely successful. It is usual to cover the upper cut end of the cutting with mud, which prevents decay. In good soil the plant grows rapidly and soon puts out roots large enough to use, but, as a rule, it takes much longer to fruit. To take the root without injuring the plant, the soil is cleared away by hand till a large enough root is found which is cut off, and the soil covered over again. Too many roots should not be taken from one plant.

SPINACHES.

Spinach.—There are a number of plants which are, or could be used as spinach here, and by far the most popular is Kangkong

(*Ipomea aquatica*,) a semi-aquatic convolvulus with white flowers, said to be a native of Arabia. It is cultivated either in water or in damp spots such as are suited for water-cress, and is propagated from cuttings. Kangkong is a very rapid grower, and gives a larger return of green stuff per acre, than any other vegetable, and is one of the most wholesome of all. The Chinese cultivate it to a large extent.

Bayam.—A name given to several species of amaranthus used chiefly by natives as spinach. The best is said to be *Amaranthus spinosus*—Bayam Duri.

Bayam Kadong (*A. gangeticus*).—Is cultivated extensively by the Chinese, being raised from seed and planted in beds. When about a foot tall, it is pulled up and sold—a large bundle for a cent. It is then a large-leaved plant, very much suggesting spinach in form, but less compact. Boiled, it much resembles spinach in colour, and has a distinct spinach flavour, being less stringy and softer than Kangkong.

Basella rubra and *B. alba.*—The red and white Malabar nightshades are creeping plants with fleshy red, or green stems and heart-shaped leaves, used as a spinach. They are grown from cuttings or seeds, usually from the former here, and the leaves are the parts used as food. The red one is the more commonly cultivated here, and is an excellent vegetable, but hardly known to Europeans in Singapore, though it is an East Indian or Chinese plant and is well known in Southern Europe. It is so easily grown and so excellent, that it is worth more attention than is usually bestowed on it.

Chekop Manis (*Sauropus albicans*).—Is a small shrub, with green leaves blotched with white, which is very popular among natives as a spinach. The leaves when cooked are rather firm in texture and slightly acid, but make a fairly good spinach. It is grown readily from cuttings.

Cosmos caudatus.—A herbaceous plant with finely-cut leaves and a head of flowers, pink, and yellow. It is often cultivated for the eatable leaves by natives, and for its flowers by Europeans. The leaves have rather a strong flavour and are not likely to find favour with most Europeans.

Purslane (*Portulaca oleracea*).—This common weed is cultivated in Europe as a vegetable, and several varieties are known. It is a succulent, usually purplish herb with small yellow flowers and is very common in waste ground. It does not appear to be used here even by the natives, but it seems popular in Holland, as it is even preserved in tins. It can be raised from seed, and is cooked like spinach.

Ferns.—Several ferns are eaten by the natives and sometimes by Europeans. They are not cultivated, but the young fronds are collected and boiled like spinach. Among the most popular are *Anisogonium esculentum*, *Paku Benar*, *Paku Tanjong* (a very

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common plant on the banks of streams), and the best of all, *Stenochlaena palustris*, "Lamiding" or "Miding" (a very abundant climbing fern), and *Ceratopteris thalictroides*—the water-fern—a finely cut fern growing in ditches and rice-fields.

CABBAGE.

Cabbage requires deep rich well-trenched soil in a position free from the shade and roots of trees. Stable manure is best for this crop and should be well dug in. The seeds may be sown in beds or in boxes of light soil and covered lightly, and as soon as big enough to handle, transplanted in rows about eighteen inches apart. For some years we have been in the habit of growing cabbages from cuttings, with a better result than from seeds. The method adopted is this. After the cabbage has been cut, the the stump is allowed to stand, and in a few days commences to sprout. As soon as these sprouts are large enough, they are removed close to the stem with a sharp knife and planted in rows at the same ditance and in the same manner as plants from seeds, and shaded for a few days. These are grown all the year round, but the best season is from the beginning of December to the end of March. Savoy cabbages, cauliflowers and Brussels sprouts are of no use.

BEANS AND PEAS.

Of the three kinds of beans grown in English gardens, *i.e.*, scarlet runners, broad beans and dwarf or French beans, only the latter is of any practical use here.

Scarlet runners indeed are stated to be always barren in the tropics, owing, it is said, to the absence of a suitable fertilizing insect.

French beans are only to be grown in the dry season, from November to February in Penang. The soil should be well dug over several times and liberally manured, the seeds planted in rows about eighteen inches apart and two or three inches deep. As soon as they are two or three inches high, a little fresh soil should be drawn lightly round the stems. Under favourable circumstances, they are fit for use in about two months. One important point is to gather them quite young. Native gardeners leave these, and, in fact, most vegetables, until they are past their best before gathering them. Canadian Wonder and Fulmer's Forcing are two of the best varieties.

Of native, that is to say, tropical beans, there are a good many kinds, several of which are very good, though without the flavour of French beans. The following kinds are best known here :—

Lablab, Egyptian Kidney-bean, *Dolichos Lab-lab*.—Kachang Karkaras. One of the commonest beans cultivated here. There are several varieties, the most distinct, however, being one with violet flowers and black seeds, and one with white flowers and white seeds. The plant is often very large, and the leaves have three very large and broad leaflets. It is easily raised from seed, and is best grown on a trellis or through bushes. The young pods are eaten like French beans, and indeed usually take their place in the plains. They are more flavourless, however, though an excellent vegetable.

Kachang-prut-ayam (*Vigna Catiang*).—Is also very extensively cultivated. It has yellow flowers, and long cylindrical green pods over a foot long. It is readily grown, usually upon sticks, and generally fruits heavily. There are several forms, but the one grown here most commonly is one with very long pods. These are cut up in pieces and boiled like French beans. They do not possess much flavour, but are a very good substitute for the latter. It is stated that the ripe seeds are eaten in India, where, however, several other forms are cultivated.

Four-angled Bean (*Psophocarpus tetragonolobus*).—Kachang botor. An annual plant with large blue flowers and square pods about 8 inches long, with four large wings. It is frequently cultivated and can be grown on sticks, as it is not a very large plant. The young pods are cooked like French beans, and are excellent sweet vegetables.

Sword Bean (*Canavalia ensiformis*) Kachang parang.—A large plant with big sweet-scented white, or more commonly, pink flowers and very large curved pods over a foot long.

The young pods are cooked like other kinds but it is rather coarser than many species, and not often seen at the tables of Europeans.

The allied sea-shore bean (*C. lineata*)) with similar flowers and short thickpods, is commonly to be found creeping on sandy beaches along the coast. The young seeds are quite eatable and, if boiled and mashed, form a good though rather dry pease-porridge.

They are, however, not commonly eaten even by natives.

Peas should be sown in rows, the distance apart depending on the height of the variety grown. The dwarf varieties, which are the kinds most suited to this climate, may be planted at one foot between the rows. Earthing up should be attended to when the seedlings are a little above the ground, and again later on, when they have attained more strength. If the taller kinds are grown they must be supported by sticks. A good plan is to grow peas on land that has been heavily manured for a previous crop, but if that cannot be done, then the manure can be put in the bottom of the trench and a good covering of soil placed over it, so that the seeds do not come in direct contact with the manure. A rich soil containing lime is the best. Early varieties are fit for use in about six weeks from time of sowing, intermediate and later kinds from eight to ten weeks. Late kinds seldom do any good, and it is best to stick to early ones, such as American Wonder, and Laxtons No. 1 (C. C.)

Peas were formerly cultivated by the Chinese in Singapore, and European residents have also grown them with success. The Chinese kind is rather small and belongs to the dwarf section. In the plains, however, peas, though with pains they may be

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made to fruit well, possess comparatively little flavour, and they are much more satisfactory when grown on the hills.

GOURDS.

The Wax Gourd (*Benincasa cerifera*) Kundur.—There are two commonly cultivated varieties of this plant here, known as Kundur Java. and Kundur China. In the former, the fruit when ripe is hairy, in the latter it is smooth.

The Wax Gourd is a large climber with yellow flowers, as large as those of the vegetable marrow, and fruit which, though always hairy when young, becomes in the commoner form (Kundur China) quite smooth, greyish green and covered with a waxy bloom, whence the name Wax Gourd. The fruit is oblong and very large, about a foot and a-half long. It is grown from seed, and allowed to creep prostrate on the ground, or better still grown over a trellis. It is eaten boiled like other gourds, and the Chinese make a sweetmeat by boiling slices in sugar and crystalizing them.

The Vegetable Marrow (*Cucurbita pepo*).—Has, I believe, never been successfully grown here, but the pumpkin grows fairly well, although it is apt to fall before fully ripe in heavy rain. We have been most successful with Italian varieties.

The large gourd (*Cucurbita maxima*).—"Labu Merah" and the Labu Manis a variety of C. pepo are also cultivated to a certain extent, but many of the larger gourds are also imported from India, and they form an important article of food among the natives They are used by Europeans in curries, or in soups, or plain boiled, being cut up into small pieces.

The worst enemies of the pumpkins and gourds are the crickets, which attack seedlings at night and devour them. I have seen a whole bed of seedlings mown down in one or two nights by a large brown cricket with light blue wings. Where these animals are numerous, it is advisable to protect the young plants with mosquito netting till they are big enough to climb, when the crickets do but little harm. A small beetle with a red head and thorax and blue elytra also attacks many of this group of plants, perforating the leaves with small round holes, but it does not appear to do much real harm.

Serpent Gourd (*Trichosanthes anguina*) Petola or Ketola Ular. —A climbing plant with rather small white flowers, with fimbriate edges and long cylindrical fruit, two feet or more in length and about two inches through, usually green marbled with white.

It is raised from seed like other gourds, and grown on a trellis, and takes about two months to bear fruit. As the fruit ripens, it is usual to tie a small stone or other weight to it to keep it straight.

The serpent gourd makes an excellent vegetable boiled in milk It is softer and of a better flavour than an ordinary pumpkin, and resembles rather a vegetable marrow. It should be taken young. for if allowed to get ripe it is bitter.

Momordica charantia—Peria.—A climber with yellow flowers, and warted orange coloured fruit, very variable in size, the seeds covered with a sweet red pulp. Often cultivated by the Chinese who generally grow it upon sticks. The fruit varies from a few inches to about a foot in length.

It is eaten young, before it becomes red. The flavour is rather bitter, and it is not usually liked by Europeans, though very popular with natives.

CUCUMBERS.

The Chinese are very successful cucumber growers, and the market is generally well supplied. They grow them on sticks in much the same manner as scarlet runner beans are grown in England. Plenty of manure applied to the soil before planting, and liquid manure twice a week, are necessary, and the crop should be ready for use in nine or ten weeks. We have tried several kinds of high class cucumbers from England with only moderate success. Indian saved seeds give a much better result, as do several of the Italian strains.

CHOCHO.

Chocho (*Sechium edule*) is a climbing perennial plant of the cucumber family, one of the most productive as well as wholesome of vegetables. This has been in cultivation on Penang Hill many years, and is said to have been introduced by a Mr. BAIN. It is best grown on a horizontal trellis, five or six feet from the ground, so that a person can get underneath to collect the fruit. The fruits are pear shaped, and should be gathered before they get too old. The root is said to be edible, but I never heard of its being used here.

Propagation is attained by leaving some fruits to ripen and then planting them whole, the pointed or stem end being inserted in the soil to about two-thirds of their depth. After they have sprouted a few inches, more soil must be placed around them or they may be transplanted to a greater depth in deep rich soil. The fruit is eaten boiled and much resembles the vegetable marrow in flavour. It is liable to the attacks of a small fly which destroys the fruit.

Bottle Gourd, *Lagenaria vulgaris*, "Labu Jantong," "Labu Ayer".—Is often cultivated and some varieties are used for food, especially a rather long pear shaped kind. It grows rapidly on trellises, and the young fruit is considered good in curries, or plain boiled.

The bottle shaped variety "Labu Kendi" which is cleaned out when ripe and used as a flask is not at least generally eaten, being grown for use as a bottle.

The Loophar, *Lufa ægyptiaca*, Petola Manis or Ketola Manis.—A climbing gourd with yellow flowers cultivated on sticks or trellis. The unripe fruit is eaten like other small gourds. The ripe fruit, cleaned of its pulp and split, is used for a bathing sponge in Europe.

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L. acutangula, the Petola Sanding.—Differs from the last in having the long cylindrical fruit with ten angles on it, the Loophar having ten low ribs only or being quite smooth. It is grown and used in the same way.

TOMATOES.

This excellent vegetable sometimes grows and fruits so well that residents often wonder why everyone does not grow it. Almost every one interested in horticulture has tried the tomato, and usually at first has obtained splendid crops, but after one or two succcessful crops, the plants take to suddenly dying off, frequently just before the fruit is ripe. This is almost invariably due to the tomato fungus, which is, if not quite, identical with the potato rot (*Peronospora*). This disease is most common in wet weather, and is very difficult to avoid, and when once it has attacked the plants, they seem to wither up in a few hours. Some cultivators grow their plants in beds, while others prefer large pots or kerosine tins. The advantage of growing them in tins or pots is chiefly that they can be moved at will to a drier or shadier position, and also that they are less liable to the attacks of wireworms, millepeds and other animals which feed on the roots. The seeds are sown thinly in boxes and planted out in the tins or beds as soon as they are big enough. One or two plants are quite enough for a tin, in beds they should be planted about two feet apart. Ground that has been well manured for a previous crop, is better than that which has been newly mannured, but a dressing of burnt earth may be dug in with advantage at the time of planting. The soil, however, should be made fairly rich in any case. As the plants grow, it is requisite to support them with stakes. A light trellis of split bamboo, to which the plants are carefully tied, is generally used for plants in tins or pots Those in beds are usually simply tied to stakes. Mr. CURTIS, however, says :—"An easy and satisfactory way of supporting is to put down strong stakes about three feet high at the four corners of the beds, and at intervals along the sides, to which are firmly tied horizontally others running the whole length and breadth, and thus completely surrounding the bed which should not be more than four feet wide. On the top of this, smaller sticks should be laid transversely at about six inches apart, and tied at each end, thus forming a horizontal trellis work." If the plants bear very heavily, it is often necessary to remove a number of the fruits when quite young, so as to allow the others to attain their full size. Though the tomato can be raised from locally saved seed, it generally deteriotates, and, usually at last the little wild cherry tomato alone is produced.

There are so many good tomatoes that it is difficult to say which is the best for our climate. The round smooth Trophy and Acme have, says Mr. CURTIS, done as well as any. The large Reds and the yellow Plum have also been grown with complete success. Tomatoes have been cultivated in Singapore by the Chinese, but not to any extent, probably on account of the disease, and as there is a great demand for them, a great many are imported into Singapore from China.

Asparagus.

Is not one of the most satisfactory vegetables grown here, and the best I have seen produced is much inferior in size to what one sees even in an ordinary garden in England, to say nothing of the gigantic specimens that are produced where the cultivation is made a speciality. Still, as it is such an excellent vegetable, and one that many attempt to grow, it is well worthy of some attention. Good drainage is absolutely necessary and plenty of manure. Stable manure and common salt are excellent. The beds should be raised twelve or eighteen inches, and the roots planted about nine inches apart. If raised from seeds it takes a long time to grow, so it is better to obtain roots if possible. (C. C.)

It seems clear that asparagus grows here best by the sea. In wet localities it is very unsatisfactory, the shoots being very slender. It has never, I believe, been grown very satisfactorily in Singapore, but in Penang and Province Wellesley, it has done much better, and I have heard of fairly good samples raised in Selangor.

Carrots.

Can be grown both in the hills and in the plains. They can be planted at almost any season, provided the seeds and young plants are protected fom very heavy rains during the first few weeks. Soil of a good depth, rather light, and a liberal supply of manure, unless the ground has been well manured for a previous crop, is what is required. The seeds may be sown broadcast on the beds or in drills about six inches apart. As soon as big enough, thin out to at least three inches from plant to plant. Do not attempt transplanting carrots as they are not worth the trouble. Bone dust or fish manure may be applied after the final thinning. Short Horn, Veitch's Perfection and James' Intermediate are three good varieties. Short Horn is the only one which is successful in the plains; it is fit for use in from nine to ten weeks. The long carrots are not at all suited for the plains. James' Intermediate is full grown in from ten to twelve weeks from sowing.

Turnips.

Can only be grown on the hills, and only early kinds such as will be fit for use in about six or eight weeks, are of any use there. Sow in drills about nine inches apart and cover lightly. As soon as big enough to handle, thin out to about six inches apart in the rows. In the plains they can only be grown for the leaves of the young plants (turnip tops), as they never form eatable roots.

Onions and Leeks.

Succeed best in rich soil. Farm-yard manure should be applied liberally, but it is best done for the previous crop, or at

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any rate some time before the land is required for sowing. Deep digging and liberal manuring the former, two or three times at least, at intervals of a week or ten days, so that the ground may become pulverised by the action of the weather, is important. Before sowing, the ground should be made smooth, all stones and hard lumps removed and the surface made firm, with the back of a spade or some similar implement. The seeds may then be sown either broadcast or in drills, six inches apart, and covered lightly. The whole surface should then be again beaten over to make it firm. If the weather be dry, watering will be necessary, and when the young plants have attained considerable size, a little guano may be put in the water. Thinning must be attended to in time, and the plants pulled out may be transferred to other beds, but they will not do so well as those grown where originally sown, so leave the best, and remove the smallest and weakest. Onions and leeks require from four to five months to grow. White Spanish from Indian saved seed is the best that we have grown. (C. C.). The Chinese also grow a rather small round white onion in the vegetable gardens.

Shallots (*Bawang Merah*).—Are much cultivated by the Chinese market gardeners, and are a most useful vegetable. The bulb splits up into a number of cloves, from which it is propagated. The cloves are planted singly or one or two together, in rows and covered with soil, which has been previously manured; well-rotted farm-yard manure is said to suit it best, but the Chinese generally use nightsoil only.

The leaves, cut when quite young, are eaten as spring onions. But if the shallots themselves are required, they are not cut, but suffered to grow till they are full grown, and show signs of withering when the bulbs are dug up. Shallots are used for flavouring, or for a curry sambal, or may be pickled.

LEEKS.

Are a very wholesome vegetable, easily grown in the hills, and remain a long time in fit condition for the table. Seeds may be sown at almost any time, but about the middle or end of November is the best. They transplant very well, and may be sown in beds or boxes, as may be most convenient. In order to have them large and white, the earth should be frequently drawn up around them as growth proceeds. London Flag and Musselburgh are the two best we have tried. (C. C.)

They cannot be grown successfully in the plains.

ARTICHOKES.

Jerusalem artichokes are the rhizomes of *Helianthus tuberosus*. They are a very popular vegetable with Europeans, being used either as a flavouring or as a dish by themselves. Now and then the Chinese cultivate them, but easy as they are to grow here, they have been a good deal neglected, very few of the Europeans even cultivating them. The roots are planted in rows about two feet apart, and it is often well to shade the plants when the leaf shoots first appear. When the plants have attained their full height and the leaves begin to turn yellow, the roots are ready for digging. The stems do not attain the height, at least in the plains, that they do in Europe, and they very often produce flowers, which is rare in England, but apparently do not set seed. Tubers for replanting should be kept for three or four months in a dry place, before planting them again. Of two varieties brought out from England, one red and the other white, the red variety gradually died out, the white one being apparently stronger and more productive. The tubers produced were rather smaller than those produced in England, and diminished still more in the third year.

POTATOES.

It is useless to try to grow these in the plains, as, even if the plant does grow, it produces no tubers. In the hills, however, they are more satisfactory, and very fair new potatoes can be grown on Penang Hill. A layer of farm-yard manure may be placed in the trenches below the sets, which should be planted about nine inches apart and eighteen inches between the rows. As they grow, they require to be earthed up to prevent the tubers getting too near the surface of the ground, and, at the same time, a little guano or bone dust may be worked in among the plants.

Early varieties are the best, but ordinary kinds obtainable in the market give fair results. If planted about the end of October they are ready for use in the middle of January.

SWEET POTATOES, KELEDI.

Are the tubers of a convolvulus, *Ipomea batatas*. They are grown from tubers or portions of tubers planted in rows like potatoes. Sweet potatoes are one of the most extensively cultivated vegetables among the Chinese, and are very prolific. Two varieties are commonly grown, a red, and a white kind. Of these the former is generally considered the better, but the local sweet potato is rather an inferior class of vegetable, being inclined to be hard and woody. Probably they would be much improved by careful manuring, but the soil in Singapore seems to be too stiff and clayey for these vegetable to do well. The tubers are often attacked by a small slender weevil, the grub of which bores holes in them, and, when numerous, quite spoils them. It seems that the white variety is more liable to the attacks of this insect than the red one.

COLUS TUBEROSUS.

Is a small herb, with oval serrated bright green leaves, and blue flowers, often cultivated as an ornamental plant for carpet bedding, but also for its tubers, which resemble small potatoes about an inch or two inches long, with an aromatic flavour. The plant is grown from cuttings or tubers, and after about four months the tubers can be dug up. They are eaten either plain

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boiled or put in soups like carrots. The plant is a native of Java, and, as a vegetable, very popular with the Javanese, but less known to Europeans. It is easily grown, and would be esteemed by Europeans if they were acquainted with it.

YAM-BEANS.

(*Pachyrrhizus tuberosus*) "Sengkuang" or Bengkuang.—A climbing bean with a tuberous root like a turnip, grown readily from seed. The root, which is said in some countries to attain a very large size is in the part eaten. It is very good raw, eaten as a radish and perhaps better cooked, as a turnip.

The beans are seldom eaten and only when quite young, as when ripe they contain a poisonous principle known as pachyrrhizin.

The plant is not very commonly cultivated.

Colocasia antiquorum, Schott, Keladi.—Is extensively culvated by the Chinese in ditches; but though the shoots are often eaten by them the plant is chiefly grown to feed pigs, the leaves being given to them. Other plants cultivated for pig food in the same way are the Water Lettuce "Kiamban," *Pistia Stratiotes, L.*, and, occasionally, *Sagittaria sagittifolia, L.*

Alocasia macrorrhiza, Schott.—Is a much larger plant, often cultivated for ornament on account of its large leaves. It has a stout cylindrical stem which is eaten sliced and boiled. It is rather glutinous, but forms a substitute for potatoes when nothing better can be had.

Yams, Ubi.—Several kinds of yam are cultivated by the natives here, but they do not enter as much into the native food supply as they do in many other parts of the tropical world.

The method of growing them is as follows:—The upper part of the tuber is cut off and divided so that each portion has one or more buds on it. Then a trench is dug about eight inches or a foot deep, in which is strewed some burnt earth and a little manure, then a layer of dead leaves is laid on this, and the portions of yams placed about a foot apart, the buds uppermost, and the earth is then thrown in and the trench filled. In a few weeks the climbing stems of the yams appear, and require a trellis or some branched sticks to climb on. The tubers can be dug in about six months.

Yams can be eaten boiled or baked like potatoes. They are apt to be rather woody if too old, but good kinds when young are an excellent vegetable.

The cultivated yams here appear to be forms of *Dioscorea alata*, L. "Ubi Teropong" is a variety with *hastate acuminate* leaves and long white tubers. "Ubi Java" has *cordate acuminate* leaves and shorter and rounder white tubers. In "Ubi Kenduduk" the leaves are deeply *cordate ovate* and the tubers small, long and red. "Ubi Nasi" has very similar leaves, but the yam is purple, large and round and is probably *D. atropurpurea*, Roxb. In all these the stems are edged with four curled wings, which are purple in the latter species, which is considered the best eating kind.

D. pentaphylla, L., with 3 or 5 foliolate leaves, wild in Johore, Pahang, etc., is used for food by the Sakais. *D. sativa*, L., which bears round brown warty bulbils in the axils of the leaves, is sometimes eaten by natives but is not considered good. It is common in waste ground, hedges, etc.

BRINJAL.

Egg-plant (*Solanum Melongena*).—Much cultivated by the Chinese, and one of the commonest vegetables in use here. It is raised from seed readily, and pricked out in beds some distance apart, as it is a very wide spreading shrub.

The varieties most popular are the long purple, and white China, both long fruited kinds, but we have also here the round purple, and round white kinds. There are a considerable number of other cultivated varieties in Europe and America, including one from the latter country with fruits as large as melons.

Several other kinds of *Solanum* are cultivated by natives for their fruits, but they are generally of an unpleasant flavour, and not at all suited for Europeans.

OKRA.

Hibiscus esculentus, Kachang Bendi or Kachang Lundi, Ladies' fingers.—Is a well known vegetable here. It is supposed to be a native of South America, and is a very handsome annual, attaining a height of about three feet, with large yellow flowers with a maroon eye. It is raised from seeds which can be sown directly in beds, or raised in boxes and pricked out when sufficiently tall. The unripe pods are eaten boiled or the young seeds served separately on toast. The pods are apt to be very mucilaginous especially if cut too young, but the amount of mucilage which exudes when the fruit is cooked seems rather to depend on the method of cooking. There are but few cultivated varieties, differing chiefly in the size and thickness of the pods.

MAIZE, JAGON.

It is strange that maize is not more generally grown for table use than it is. This is perhaps largely owing to the fact that few Europeans know that there are varieties, specially selected for eating, vastly superior to the field kinds. These varieties have mostly been produced in America, where there are more than a dozen named kinds cultivated.

No special care is required to grow this plant, but deep digging and plenty of manure are necessary. Seeds should be planted in rows three feet apart and about one foot between the plants. It is best to plant two seeds in each hole, and then pull out one plant if both germinate. Cattle manure, bone dust, fish manure and burnt earth are all good for this crop, and in dry weather, liquid manure twice a week.

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Early kinds are fit for use in eight or nine weeks. The cobs are gathered before they are too old, boiled and served with pepper, salt and butter. Good eating kinds are Adams Early, Early Dwarf Sugar, Stowell's Evergreen and Large Missouri.

Another way of using maize is to germinate the ripe seed by laying it on a stone or cement floor, damping it with water and, covering it with a wet cloth. When the seed has germinated, the roots, etc., are broken off from the hard outer seed coat and boiled. This makes an excellent vegetable.

The chief enemies of maize here are a caterpillar which attacks the young fruit, and the maize fungus *Ustilago Maydis* which grows on the cobs, destroying them and covering them with a sooty mass. This disease, so destructive in other parts of the world, is, however, comparatively rare here.

MUSHROOMS.

Although the English mushroom (*Agaricus campestris*) is a native of the Malay Peninsula, occurring in Singapore, Penang and Pahang, no one seems to have been successful in cultivating it here. It appears very irregularly in old grass-plots, sometimes in some quantity, and is as good in flavour as the English one. The Malays consider it unfit to eat, although they eat several other species of *Agaricus*, one of which, a white kind, grows on rotten wood in the jungles. This is tasteless and tough when cooked, but it is very popular with them.

A yellow ball-shaped fungus, *Scleroderma aureum*, Massee, growing commonly on paths in woods, is also said to be eatable, and to resemble truffles in flavour. An allied species is said to be eaten in Germany.

THE POISONOUS PLANTS OF THE MALAY PENINSULA.

Plants possessing poisonous qualities have almost always a special value as drugs and are always worthy of careful investigation, not only on account of their medicinal value, but also from the fact that they are liable to be used for criminal purposes or to be the cause of accidents to human life.

The number of plants possessing poisonous properties in the Malay Peninsula is by no means large, and of those that are stated to be dangerous to life, but few have been at all carefully studied, either by analysis or experiment. Indeed, a vast amount of work in the analysis of our vegetable products remains to be done, when a suitable Laboratory is provided in which they can be properly investigated.

Criminal poisoning is by no means as common here among the Malays as people are led to suppose. The variety of poisons used is quite small, and apparently the knowledge of their use is mainly derived from the Chinese. The poisonous plants of the forests are seldom used by the Malays, who do not seem to know how to prepare them. It would appear, however, that there are deadly drugs known to the natives which have not been identified, and to which we have at present no clue at all.

The Malays always distinguish between poisons which cause death (*Rachun*) and those which intoxicate or produce sickness (*Mabok*). The latter class includes a number of drugs which have really but little effect on the body.

Most of the vegetable poisons known to Malays are those which have been used as blood-poisons on the poisoned darts of the wild tribes, and of these, some contain well-known alkaloids or other principles, such as *Strychnos Tieute* which contains Brucine, and *Pangium edule* which contains Hydrocyanic Acid. Others again are not known to contain any poisonous principle, although they are commonly reported to be poisonous.

For convenience I treat of the plants used in dart-poison together, as far as they have been identified, and some of these are here identified for the first time The poisoned darts of the Malayan Peninsula and the islands have been known for many centuries, and a good deal has been written about them by travellers. The most important one Antiaris (*Ipoh* or *Upas*) has been made the subject of a number of papers, but even now our knowledge of the drug is far from complete and within the past year even, it has been stated that the Antiaris of the Malay Peninsula is innocuous which is very far from being the case.

The most complete accounts of the plants used in the dart-poisons of the Sakai tribes, are those of Vaughan-Stevens and Newbold. The former supplied me with pencil drawings and specimens of the plants used by the tribes with which he came in contact, and I have been able to identify most of them, and to confirm his statements as to their use by reference to other races

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of Sakais. Newbold's account is less satisfactory, as he adds several doubtful ingredients to the arrow-poison, *e. g*, Arsenic, but most of his statements appear to agree with those of Stevens, Horsfield and others.

I give a list of all vegetable poisons stated to be used by the Sakais or other wild tribes of the Peninsula in the manufacture of dart poison, in their natural order.

List of Plants used in Dart-poison by the Wild Tribes.

Plants.	Natural order.	Native Names.
Coscinium fenestratum, Colebr.	(*Menispermaceæ*)	Tole ; Koopur ; Kopah.
Pangium edule, Bl.	(*Bixineæ*)	Payung; Kapayung
Roucheria Griffithiana, Planch.	(*Lineæ*)	Bhoi (Sakai); Ipoh akar putih.
Miquelia caudata, King.	(*Olacineæ*)	S'lowung.
Lophopetalum pallidum, Laws.	(*Celastrineæ*)	Kroi, Krohi.
Derris elliptica, Benth.	(*Leguminosæ*)	Tuba.
Medinilla sp.	(*Melastomaceæ*)	Sendudu.
Aralidium pinnatifidum, Miq.	(*Araliaceæ*)	Balai, Malai, Tingal balai.
Coptosapelta flavescens, Korth.	(*Rubiaceæ*)	Prual.
Prismatomeris albidiflora, Thw.	,,	Mundess.
Strychnos Tieute, Bl.	(*Loganiaceæ*)	Blay hitam; (Sakai) Ipoh akar.
Str. sp. probably *S. Tieute* Bl.	,,	Akar lampong.
Str. pubescens, Clarke.	,,	Blay besar, Talun.
Str. Wallichii, Benth.	,,	Perghoo.
Tabernaemontana Malaccensis, Hook, fil.	(*Apocynaceæ*)	Perachit.
Piper stylosum, Miq.	(*Piperaceæ*)	Blay pendy.
Antiaris toxicaria, Bl.	(*Urticaceæ*)	Ipoh, Ches Tennent.
,,	,,	Tennik, Kennik.
Laportea crenulata, Forst.	,,	Rumpe (Sakai) ; Jelatang.
Cnesmone javanica, Bl.	(*Euphorbiaceæ*)	Jelatang Rusa
Excœcaria Agallocha.	,,	
Gnetum edule Bl.	(*Gnetaceæ*)	Blay merah, Blay kechil.
Dioscorea doemona, Roxb.	(*Dioscoreaceæ*)	Gadung.
Amorphophallus Prainii, King.	(*Aroideæ*)	Likir, Lokie, Begung.
Epipremnum giganteum, Schott.	,,	Ringut.
Homalomena sp.	,,	Nampong.
Alocasia denudata, Engl.	,,	Berar kijang.
Daemonorops sp.	(*Palmæ*)	Rotan riong.
,, ,,	,,	Rotan butong.

Unidentified plants mentioned by VAUGHAN STEVENS, are Bal, Grow (chow) Choichoi, Lendow, Garsung.

IPOH, *Antiaris toxicaria*, Bl.

The best known poison of the East Indies is the Ipoh or Upas, as it is called in Java, the produce of *Antiaris toxicaria*, Bl. one of the *Urticaceæ*. It is mentioned in almost all of the earlier books of travel in the East Indies, and, as will be seen by the list of references to the drug, it possesses a considerable amount of literature. A great deal of the earlier accounts of it were very erroneous, notably the account by Foersch whose description was for a long time firmly credited, and some of whose blunders have only recently been completely exposed.

The tree is allied to the *Artocarpi* and *Ficus*, and as in these there is abundant milk or latex readily exuded from wounds in the bark, but whereas in these the latex contains nothing more harmless than Caoutchouc, in *Antiaris* there is a remarkable resin which, on being injected into the blood even in small quantities, produces a violent action usually speedily terminated by death.

This property is made use of by the Sakais of the Malay Peninsula, the Muong of Tonkin, the Bataks of Sumatra, and formerly by the Buginese of Macassar, and the Javanese. The latter used it with great success in war, as may be seen in the account of the taking of Malacca by Albuquerque.

Its use is now confined to the wilder tribes of the East who, not possessing fire-arms, poison the darts shot from the blowpipes (*Sumpitan*) with which they kill monkeys and other small game. It appears never to be used for poisoning *krisses*, as is popularly supposed, and it is probable that it never was so used.

A few years ago I noticed that a large number of the experiments made with the poison, were made either with the darts used by Sakais or with a mixture of several ingredients made by them, and, naturally, the results were vitiated by this, and I made some experiments with the pure juice, in order to eliminate the action of the other poisons used in the preparation. At that time, too, specimens of the unmixed juice had been sent to Kew for analysis and experiment, and it was stated that the latex contained no poisonous properties. The fact is, however, that fresh extract, unless very carefully dried, putrefies in a few days, evolving sulphuretted hydrogen, so that the specimens sent to Kew had decomposed ere their arrival. I had intended to experiment further with the drug, but the large tree in the Botanic Gardens died, and the others were too young to afford sufficient latex.

As already mentioned the Sakais use a number of other extracts with the *Antiaris* for the dart-poison, including a preparation from the bark of at least one species of *Strychnos*. Of many of these, I received specimens and sketches from the late Professor Hr. Vaughan Stevens, who published an account of them in a German periodical.

The use of some of the same plants is mentioned by BLUME in his important paper in Rumphia, and these will be treated of later.

Mr. Wray, in a paper published in the Perak Government *Gazette* (Sept.11, 1891) states that Antiaris *Ipoh* and *Ipoh akar* (*Strychnos Tieute*) are rarely, if ever, mixed together and that the *Strychnos* is often used alone. This observation appears to be true in respect of the Perak wild tribes only. A Jakun in Malacca told me some years ago, that his tribe used the latex of the *Antiaris* and the extract of *Strychnos* together, but no other extracts. Some Selangor Sakais near the Batu caves told me they used several ingredients besides the *Strychnos*. Mr. SKEAT mentions the use of all the commoner ones among the Besisi tribe, and all other writers allege the same thing, viz., that the dart-poison is not merely *Antiaris* latex.

In my experiments, detailed later, I first, acting on the Jakun's statement, used the sap of the *Strychnos* alone, then later of *Antiaris* and also the two combined.

DESCRIPTION OF THE IPOH TREE.

Antiaris toxicaria, Bl. is a gigantic tree attaining a height of over a hundred feet and a diameter of four or more above the base where it throws out large buttresses. The bark is grey, about half an inch thick. Like nearly all of our largest trees, it drops the lower branches as it grows, so that a large specimen has a perfectly bare trunk for some sixty or eighty feet. The leaves vary very much in size and hairiness, they are generally oblong acuminate inæquilateral, from four to six inches long, and two or three inches broad, the leaf-stalk a quarter of an inch long the backs of the leaves as well as the buds are covered with yellow hairs, and the upper surface of the leaf is more or less hairy, especially in the case of young leaves, though older ones are often glabrous above. The male inflorescence is a small, fleshy green disc-shaped body on a short peduncle; and the flowers which are very small are imbedded in it. The female flowers are small, solitary, pear-shaped bodies with a pair of long, thread-like styles. The fruit is a globular succulent drupe about a third of an inch long, velvety and of a deep claret colour, and bears the remains of the styles. It contains a single, round seed.

Blume describes the fruit as of an elongate ellipsoid form and as big as a plum. Specimens, however, from near the caves at Kwala Lumper, in Selangor, were much smaller and quite globular.

ACTION OF THE POISON.

The following experiments, incomplete as they are, are, I think, worth recording :—

Experiment 1.—I obtained a small, brown, pariah bitch in complete health and at 11 a.m. injected into its back with a hypodermic syringe 10 mm. of the sap of *Strychnos Tieute*, a clear, tasteless liquid obtained by cutting the roots across and letting the sap drain into a vessel. There was no result. (I found afterwards that the Sakais used a decoction of scrapings of the bark and not the sap. The sap, however, is said to contain a small amount of Brucine and sap obtained from the stem I have found to be intensely bitter).

At 5-10 p.m. I injected into the abdominal walls, 5 mms. of pure latex of the *Antiaris*, a very sticky liquid, difficult to inject as it clogged the syringe. The breathing of the dog became slightly more rapid and it became sleepy, but soon became lively again and nothing further happened. At the post mortem examination I found no discolouration at the point of injection, but the latex had been completely absorbed.

I cannot account for the failure of the poison to affect the dog, unless it was that the part selected was not very vascular and the drug was only slowly absorbed.

I then mixed the two liquids in equal parts, making a much more fluid drug easy to inject and injected 10 mm. into the lower part of the abdomen, the point of the syringe entering one of the mammary glands. Time 5-40.

5-43. Dog uneasy, yawned much, breathing heavy.
5-45. Breathing very hard and rapid.
5-47. Dog vomited, then breathing became easier.
5-48. Dog retched violently and became very restless. The tongue became blue.
5-50. Slight convulsions. Breathing nearly normal.
5-52. It lay down and got up again after a minute, and passed solid fæces.
5-54. It stood still with its head hanging down, groaned, and frothed at the mouth.
5-55. It lay half-down, bit at the straw and the chain, and seemed to be in much pain. The abdomen was moving rapidly, apparently convulsed. The dog was still sensible, and uttered cries.

It was then killed with a blow on the head, which unfortunately broke one of the large vessels in the head or neck, and caused a great flow of blood from the mouth. I immediately opened it.

At the point of injection, one vessel was heavily charged with venous blood, and the whole of the gland discoloured. The stomach was empty and, with the intestines, very pale and bloodless. The kidneys pale. The lungs quite empty of blood, as were the upper vessels. There was a little in the heart, which was not contracted.

I could not get any more dogs, so continued the experiments on toads (*Bufo melanostictus.*).

I first injected a small toad with the sap of the strychnos and poured some down its throat, but as this had no effect on it, I did not use any more in the rest of the experiments.

Experiment 2.—At 12-36 p.m. I injected 11 mm. of *Antiaris* latex ito the left thigh of a fairly large toad.

1-5. Great uneasiness. It lay flat on its belly, had slight convulsions, passed urine. The breathing became very hard. The legs very weak.

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1-15. Pupils of eyes contracted much, but not yet permanently. It had a spasmodic contraction of the fore-legs. When turned on its back it could not recover itself.

1-20. It was quite unable to move. The pupils very much contracted. Eyes still sensitive to touch. Breathing very faint.

1-35. Laid it on its back. Voilent convulsions. Eyes no longer sensitive to touch. Spasms of pectoral and abdominal vessels. It was practically dead.

Post-mortem Examination.—Brain normal. Heart still beating, momentarily checked by convulsions. Lungs full of air. Vessels of abdomen and chest very full of blood. Stomach and intestines; vessels on the outer coat congested, inside not congested, stomach full of clear shiny liquid, colon full of the remains of grasshoppers, &c. Liver congested, gall bladder dark and full. (This appears to be always the case after an injection of *Ipoh.*) Kidneys full of blood.

B.—Another toad was injected with equal parts of *Strychnos* juice and *Antiaris* milk, at 12-47 p. m.

12-48. Breathing rapid, sides throb violently.

1-20. Passed urine and fæces.

1-25. Commenced to get weak.

The animal was then pithed and opened. The throat muscles were still active. The viscera on the whole were generally less congested than in the previous case, except the lungs which contained more blood. Application of the mixture to the now quiescent intestines and stomach produced violent peristaltic action (the application of water, and mechanical irritation having previously produced no result). Pure *Antiaris* latex applied produced instant and violent contraction of the intestine transversely. This contraction which lasted for some minutes was most violent in the colon.

C.—A similar toad injected at 1 p.m. with 5 mms. of the mixture.

1-2. Abdomen commenced to twitch. Beat of the heart became more violent.

1-5. Twitching of the abdomen increased in violence. Toad attempted to vomit once.

1-20. It commenced to lose the power of its limbs. Passed excreta.

1-25. Pupils contract. Breathing very faint.

1-55. Nearly dead. Eyes but little sensitive to touch.

2 p. m. Quite dead.

Post mortem examination.—Brain normal but with more liquid above it than usual. Lungs full of air. Heart black at the apex, outer wall congested, auricles full. Liver and spleen congested, as were the mesenteric and other abdominal vessels. Gall bladder full and black, much perivisceral fluid.

D.—Administered 5 mm. of the mixture by the mouth, to a toad. No effect.

E.—At 3-30 p.m. injected into a toad 5 mms. pure *Antiaris* latex, at 3-40 it was very weak, at 3-50 it had slight convulsions, at 4-0 it died. The action of unmixed *Antiaris* is much more rapid than the mixture.

F.—A toad was pithed and opened. *Antiaris* latex applied to the heart produced irregularity of beat, viz:—

32 beats in 25 seconds.
19 ,, in 14 ,,
20 ,, in 17 ,,
27 ,, in 25 ,,

The intestines, specially the colon, contract violently when the *Antiaris* latex is applied to it at the point of application.

G.—A toad was pithed and the thorax opened, and the heart beats recorded at 4 p.m.

At first there were	25 beats in 15 seconds.
Antiaris latex applied to heart...	20 ,, ,, ,,
A second application	21 ,, ,, ,,
3mms. injected under skin of thigh	24 increasing to 27 ,,
The sides began to twitch, and a second injection as before was given	26 beats in 15 seconds.

Convulsions set in. More *Antiaris* milk was applied to the heart, and the action became irregular(23 beats).

Irregularity of heart action increases, and the action is weaker (21 beats). Convulsions every two or three minutes.

Heart very irregular and feeble 20 beats.

At 4-20. The beats had fallen to 13½ in 15 seconds.

H.—Two toads were pithed and an opening made over the heart. In No. 1 the upper part of the heart was slightly cut by accident but not so as to inflict any real injury.

No. 1.	Heart beats in 15 seconds	16½
	Antiaris applied to base of heart	20
	After a few minutes fell to	18
	Pupils much contracted and nearly closed.	
	Injected 2 mm. into thigh	22
	Violent spasms	23

The heart beats now became more pronounced, and the animal became weaker and weaker till life was almost extinct. Electric shocks were adminstered which, did not affect the heart, but only the motor muscles.

No. 2.	Normal heart beats	18½ in 15 seconds
	At 8.54 p.m. injected 2 mm. *Antiaris* milk— ...	19 to 20

At 9 p.m. a very slight contraction of the pupil. The heart beats still normal.

9-3.	Slight spasms of the abdomen. Beats ...	17
9-10.	,, ,, ,, ,, ...	9
9-25.	,, ,, ,, ,, ...	6

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9-40. Administered several strong electric shocks. It discharged urine violently and shortly after died, probably from the shocks.

I.—A toad sound and unopened, had a normal beat of 23 in 15 seconds.

At 10-30, 2 mms. *Antiaris* was injected. Beats 21
10-37, „ „ „ „ 20
10-42. „ „ , „ 18

J.—In order to see if the poison was destroyed by heat, some *Antiaris* latex was boiled in a test-tube. It emitted a smell of burnt india-rubber.

Injected three mms. into the thigh of a toad at 9-25. At 9-45, toad much affected. It does not move, but lies on its back, and does not attempt to recover itself. The pupils are contracted. There are no spasms, but a complete loss of motor power in the legs, the fore-legs first. It died at 10 a.m.

This experiment shows, I think, that boiling greatly increases the rapidity of the action. All writers state that the Sakais boil the decoction till it becomes thick before using it.

Newbold (Trans. Roy. Soc. 1837, p. 427) in describing the poison, gives an account of inoculating a pup with one of the arrows of the Aborigines, the effects of which closely resemble those in my experiment on the dog. It was struck in the right hip, the arrow penetrating only a quarter of an inch. Six minutes later "it demonstrated signs of uneasiness, yawned and moaned. In "10½ minutes it grew sick, vomited the contents of the stomach "and continued at intervals bringing up small quantities of a "white frothy liquid. In 16 minutes the muscles of the chest "and diaphragm were powerfully excited; slight convulsive "twitchings in the legs. In 20 minutes it fell on its side, foamed "much at the mouth, again got on its legs and struggled violently as if to get loose. In 23 minutes it was still foaming at the "mouth and had an involuntary alvine evacuation, then fell "down after painful retching" and continued this, becoming gradually weaker till, in 37 minutes, it died strongly convulsed.

The post-mortem examination showed a frothy saliva-like fluid in the stomach, the gall-bladder distended with bile, the intestines unusually pale. In the cavity of the thorax on each side were several drachms of serous fluid. In this experiment, as apparently in others by Newbold, the action of the poison was very slow, probably on account of the small amount of the drug injected, otherwise the action was quite similar.

One more experiment I made I will mention. A tadpole was put into a watch-glass of water, and a little of the *Antiaris* latex injected into the tail by a prick. Under the microscope, the blood-vesseles could be seen to become intensely congested, and the circulation in the tail gradually ceased, the capillaries of the tail becoming choked with corpuscles. It appear- to me that this was due to the contraction of the capillaries.

From these experiments, I gather the following as the results of the action of *Antiaris* latex on injection. The heart-beat at first rises in frequency, then immediately commences to fall till death. The intestines, especially the colon and stomach, contract rapidly and convulsively, and the contents of the latter, and often that of the former, are ejected. The pupils of the eyes contract. The blood is congested in the mesenteric vessels, the spleen and liver, and often in the outer walls of the stomach and intestines, but the inner coats are nearly bloodless. The brain and spinal cord do not seem ever to be affected. The loss of power of the limbs which sometimes occurs, does not appear due to paralysis; it only comes on towards the death of the animal, and seems to be due merely to the general collapse. Death is not due, in most instances at least, to the convulsions of the digestive tract, but apparently to some interference with the heart's action.

Horsfield, who wrote a paper on the poison and its effects, describes the symptoms and the post-mortem appearances in a very similar manner. He says that in animals killed by *Antiaris*, the aorta and venal canals were in every case found in an excessive degree of distention, the viscera in the vicinity of the source of circulation were uniformly filled to a præternatural degree with blood, which still retained a florid colour and was completely oxygenated. On puncturing the vessel, it bounded out with all the elasticity and spring of life. The vessels of the liver, stomach and intestines, and of the viscera of the abdomen in general, were also more than naturally distended, but not in the same degree as the breast. The stomach was always distended with air.

The records of the action of *Ipoh* upon man are very scanty, the use of the poison in war having been long given up, and the few observations on its effects made some centuries ago being naturally very inadequate.

At the siege of Malacca (Albuquerque, Hakluyt's voyages, vol. ii) it was remarked that all soldiers wounded with the darts died, except one man who was burned with a red-hot iron directly he was struck, "so that ultimately God spared his life."

Wray describes an accident with a dart in Perak thus.—

"While unloading and carrying the baggage over the rocks, a poisoned blowpipe dart fell out of a quiver and stuck in the upper part of one of the men's feet. It was at once pulled out, and a Semang squeezed the wound to get out as much blood as possible, then tied a tight ligature round his leg, and put lime-juice into the wounds. The man complained of great pain in the foot, cramps in the stomach, and vomited, but these symptoms soon passed off. The point only went into the foot about $\frac{1}{8}$ inch and the dart was instantly pulled out. The Semangs said that, had it gone deep into the fleshy part of the body, it would have caused death."

From this account, I think, it may be gathered that *Antiaris* has practically the same effect upon man that it has upon other mammals.

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The supposed deadly effects of sleeping under the tree, and putting the latex on the skin, have been shown by VAUGHAN STEVENS to be mainly at least imaginary. He sat under the tree when the latex was exuding and slept for a whole night beneath it, and also covered his hand and arm with the latex, and held his head over the steam of the boiling liquid for an hour, without experiencing any ill effects.

He, like myself, has drunk the latex in small quantities without feeling any poisonous effect. Horsfield however states that taken into the stomach of a dog, the *Antiaris* produces nearly the same symptoms as it does when injected. Oppression of the head, twitchings, faintness, laborious respiration, violent contraction of the muscles (pectoral and abdominal), increased flowof saliva, vomiting, great restlessness, agony, etc.,for nearly two hours, but after evacuation of the stomach, the animal gradually recovered.

I have not been able to obtain this effect and have already mentioned that, on giving a toad a quantity internally, no effect was produced, though these animals are very sensitive to injected *Antiaris*.

REMEDIES.

Most of the Sakais say that there is no cure for a wound poisoned with Ipoh, they themselves having usually recourse to charms. But several methods of treatment were proposed or recommended in the early days of the opening up of the Malay Archipelago, when explorers were liable to be attacked by natives armed with blowpipes and darts, especially before the introduction of firearms, when the *sumpitan* was the common weapon of defence. Most of these proposed remedies need be mentioned only as curiosities. Actual cautery has already been mentioned as used at the siege of Malacca, but the method most in repute in the East Indies was to cause the patient to swallow his own excrement. The object of this was to produce violent vomiting. Rumphius, who with others recommends this, recommends also the use of *Crinum asiaticum*, the tubers of which are to be crushed, and some of the juice to be swallowed, and some placed on the wound. This plant, a common sea-shore plant with white lily-like flowers, was formerly included in the Pharmacopœia of India as an emetic. The same author urges the use also of sea-water, or a solution of chloride of sodium, on the ground that violent vomiting must be produced, or the patient has no chance. He advises, too, the use of water melons to extinguish the burning of the intestines. Kœmpfer recommends the use of *Ophiorrhiza Mungos* as an antidote to all poison. It is a herb which has long ceased to have any medicinal reputation at all. NEWBOLD mentions a plant called Lemmah-kapiting as used by the aborigines against the poison ; I have never met with any such name, and he gives no clue at all as to what the plant is like.

THE CHEMISTRY OF ANTIARIS

Has been studied by a considerable number of Analysts. Professor H. W. Bettink (Haaxmans Tijdschrift, 1889) found three principles in the latex, viz., Antiarin, Œpaine (Upaine) and Toxicarine. Mr. Stockman (Pharm. Journ. 1893, p. 946) gives a note on Antiarin which he compares with Strophanthine and Urechitine. He found that while $\frac{1}{4500}$ grain of the former and $\frac{1}{2600}$ of the latter poisons were fatal to good-sized frogs, $\frac{1}{6400}$ grain of Antiarin was fatal within 24 hours, and that the smallest lethal dose caused stoppage of the heart in diastole, larger doses in systole. Antiarin is obtained by exhausting the latex with boiling alcohol and evaporating to dryness, and after the deposition of the Antiar-resin, treating the extract with water and evaporating to a syrup; the antiarin then takes the form of scales which are purified by recrystallization. (WATT'S Dictionary of Chemistry.)

The latex preserves very badly, becoming putrid very soon unless properly prepared by boiling and drying. As all trace of poison disappears on the decomposition of the latex, samples of juice put up simply in bottles and sent to Europe have been found on arrival to be inert, so that it has been stated that the Antiaris of the Malay Peninsula is not poisonous.

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COSCINIUM FENESTRATUM, Colebr. (*Menispermaceæ*).—Tole Koopur (Vaughan-Stevens), Kopah (Newbold), a stout climber with peltate leaves on long petioles, white or yellowish beneath,

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with strongly raised ribs and reticulations. Flowers very small, green, in small heads arranged in a panicle. Fruit globular, tomentose, about ¾-inch through. The stem has the remarkable structure of other plants of the group and is yellow when cut. The taste is very bitter. The root is known in trade as false Calumbar root, and is said to have almost the same properties as the true Calumbar, being medicinally used for dyspepsia and fever, in India. It contains Berberine. The plant is a common jungle climber here.

According to Vaughan-Stevens, the sap from the stem and a decoction of the bark are added to the Ipoh-mixture, and Newbold also mentions its use by the Mentera tribe. There does not seem to be any really poisonous principle in the plant, and it is not easy to see why it should be mixed with the Ipoh.

MIQUELIA CORDATA, King (*Olacineæ*).—S'lowung, is a slender climber with curious, oval beaked flattened, red fruit, which, according to Vaughan Stevens is added to the Antiaris mixture.

It is a rare plant, only met with in Perak, and nothing is known of its properties.

PANGIUM EDULE, Reinwt. (*Bixineæ*).—The Payung or Kapayung, a large tree with big ovate leaves, rather large axillary greenish-white flowers and oblong brown fruits a foot in length, containing a number of large seeds nearly two inches long, woody and grooved, enclosed in an oily pulp. The seeds produce an oil used by the Malays for lighting and cooking, and according to Vaughan Stevens, are also used in making dart poison by the Panghans. He states that they are cut small and boiled for four hours in as little water as possible, and the pressed out juice is added to the other poisons. In some of the islands of the Archipelago the seeds are boiled, the kernel taken out and pounded, and then macerated in water and used as a sauce, but this is apparently not commonly done, as, unless very carefully prepared, it produces diarrhœa. The pounded seeds are used in Pahang to attract fish. The bark, however, thrown into water, is stated to act as a piscicide, and the juice of the leaves is used for curing ulcers, and the kernels, chewed (care being taken not to swallow the juice), are used for killing vermin. (RUMPH, Herb. Amboinense). Blume, who in Rumphia (Vol. IV, 21), gives a good account and figure of the plant, states that it is used as an anthelmintic.

The poisonous principle has been shown by Greshoff (Nuttige Indische Planten) to be Hydrocyanic acid, a sufficiently deadly blood-poison.

The tree occurs abundantly in Selangor, Pahang, and Perak, and in most of the Eastern Archipelago.

The allied genus, *Hydnocarpus*, contains several poisonous species, *e.g.*, *H. venenata* Gaertn. of India, used to kill fish, and *H. heterophylla* of Java. A plant known as Sayang in Malacca appears to be a species of *Hydnocarpus*, and is stated there to be poisonous.

Roucheria Griffithiana, Planch. (*Lineæ*).—A common woody climber known as Bhoi by the Sakais, and Akar Ipoh putih by the Malays, the bark of which is used by the Sakais for mixing with the antiaris. The stem attains a thickness of about 4 inches with a white bark (whence the name Ipoh putih). It possesses curious curved hooks by which it climbs on other bushes and trees. The leaves are small, lanceolate, dark green. The flowers numerous in axillary tufts are bright yellow. The fruits are small bright red drupes.

Nothing is known as to the properties of this plant but, as it is evidently reckoned to have poisonous properties by the Malays and Sakais, it will be well worth examining.

Lophopetalum pallidum, Laws (*Celastirneæ*). — Krohi, Kruoi (Besisi dialect, Skeat), Krabu (Malay), is a gigantic tree with lanceolate, rather stiff leaves, about two or three inches long, turning glaucous when dry, with about eleven pairs of main nerves. The fruit a large, oblong capsule, woody, breaking up into boat-shaped valves, outside black and shagreened, inside shining brown, length about four inches, the seed flat with a long, brown wing as long as the capsule.

This plant much resembles *L. Curtisii*, King, of Penang, but that has smaller and rounder leaves with fewer nerves, and I take it to be the little known *L. pallidum*, Laws.

The Kroi is mentioned by Vaughan Stevens as used by the Menteras in combination with Tuba, and I have specimens of the leaves and wood from him. I found it was known to the Sakais of Selangor, some whom I met near the Batu Caves, evidently setting much store by it. Newbold (Malacca ii p. 399) talks of three preparations used by a tribe from Sungei Rhya—Ipoh Krohi, Ipoh Tennik or Kennik and Ipoh Mallaye, and says that the Ipoh Krohi is composed of Krohi (extracted from the Ipoh tree), Tuba, Kopah, red arsenic and lime juice, and Ipoh Tennik is made in the same way, omitting the Kopah. This is probably erroneous, as Tennik is simply a Sakai word for *Antiaris*, and Kroi is an entirely different tree.

The bark and outer part of the wood of the *Lophopetalum* are the parts used in the decoction. No examination of this tree has yet been made, but, as it is evidently considered a valuable addition to the Ipoh, it probably contains some poisonous principle. Another species of the same genus, *Lopho petalum toxicum*, Loher, has just been described in the Icones Buitenzorgenses (Vol. 1, p. 56, Fig. 16), of which the bark is used by the Negritos of the Philippines for poisoning their arrows.

Aralidium pinnatifidum Miq. (*Araliaceæ*).—Malai or Balai (Mallaye, Newbold), Tingal Balai, a shrub or small tree about twelve feet tall. The leaves are oblong and rounded at the apex or deeply lobed, being cut nearly to the mid-rib. They are usually about a foot long. The flowers are small and greenish white, in large terminal panicles. The fruit is an elliptic oblong drupe,

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black in colour, and possessing an unpleasant soapy taste. It is about an inch long, and contains a single seed.

The plant is common in open woods and jungle borders all over the Peninsula as far north as Kedah.

This is mentioned by Newbold as forming part of the most potent of the three poisons described by him. It is used according to him with Tuba, Perachi (*Tabernœmontana malaccensis*), Kopah (*Coscinium fenestralum*) and the "Chey." Mr. Skeat sent me also a piece of the plant as used by the Besisi under the name Balai or Malai.

About its properties nothing is known, though the leaves are used by the natives in cases of rheumatism.

STRYCHNOS TIEUTE, Bl.—This, the Ipoh Akar or Blay Hitam of the Sakais, is a strong woody creeper attaining the length of a hundred feet or less, and a diameter of three inches. The bark is smooth and black. The branches usually fairly stout, climbing by means of rather large woody hooks. Leaves, polished dark green, oblong acuminate, with the characteristic three parallel nerves as in other species, three inches long and about one and a half wide. The flowers are small and tubular, with four lobes to the corolla, greenish white; they are arranged in short axillary panicles about an inch long, in pairs. The fruit is a globular berry about two inches through, of a greenish grey colour. The rind about ⅛ inch thick, is woody but brittle, and encloses a soft whitish pulp, in which are imbedded numerous oblong flattened seeds about half to one inch long, and half or more wide, brown with a silky coat. Every portion of the plant has an intensely bitter taste due, as has been shown by H. & G. Santesson (Archiv. de Pharmacie, 1893, 591) to Brucine. Intensely bitter as is the fruit and especially the pulp enclosing the seeds, both monkeys and civet cats eat it, the latter appearing especially fond of it.

The Ipoh Akar is abundant over the greater part of the Peninsula, occurring in Singapore, Malacca, Perak. It is also found Java.

The Sakias make a decoction of the scraped rind of the climber which they add to the Antiaris milk.

I have little doubt as to the correctness of the identification of this plant with Blume's *S. Tieute*, though he both describes and figures the fruit as red when ripe, which it never is here.

The Ipoh Aker (*sic*) and Aker Lampong, specimens of which were sent to Kew by Mr. Wray, are stated to be possibly *S. Maingayi*, Clarke, but this plant, at least the "var.? *furctuosa*," does not appear to be clearly distinguishable from *S. Ticute*, Bl., which is omitted from the Flora of British India, though our commonest species. The specimens were chemically examined by Mr. STOCKMAN, who found that they produced effects like that of Digitalis and not at all like Strychnine (Pharmaceutical Journal 1893, p. 945). Santesson, in several experiments on frogs and mammals with the Ipoh Akar of Vaughan Stevens (*Str.*

Tieute, Bl.), obtained the characteristic convulsions of Brucine. Stockman's material was very limited, and it could not be exhaustively analysed, but if Wray's Ipoh Aker and Aker Lampong have an action on the heart like Digitalis, and not on the nervous system like Brucine, they must surely be different from *Strychnos Tieute*, and are probably not *Strychnos* at all.

Another climbing species with small hairy leaves about an inch long, and small yellow plum-like fruit, is used by the Sakais in the same way as *Str. Tieute*, but less frequently, under the name of Blay besar. It is perhaps *S. pubescens*, Clarke, but the specimens I have from Vaughan Stevens are insufficient to identify it.

He describes the plant as follows:—Leaves small, very minutely woolly, particularly on the upper surface, short tendrils, generally from the second leaflet from the central stem, but not on every twig. Main stem of vine 27 inches in circumference up to 200 feet long. About fifteen feet lies on the ground with numerous roots, four inches in circumference. The bark is greyish, dark green and reddish; on scraping, reddish yellow; wood soft and white. The stem divides into branches and re-divides as it goes up the tree. The foliage is only at the extremity of the branches and does not make a very large total.

"Perghoo" also mentioned by Stevens, resembles somewhat *Strychnos Wallichiana*, Benth., but I have only one or two leaves of it, and have never seen anything else like it in the jungles. Oompas pite described by the same author as used by the Menteras and other tribes where *Antiaris* and *Strychnos Tieute* are unprocurable, is also apparently a species of Strychnos, but the specimens are inadequate for identification. "Oompas," *i.e.*, Umpas, appears to be a variant of Upas, and "pite" may be intended for "putih" white. The plant is, however, not the Ipoh Akar putih (*Roucheria Griffithiana*) of the Malays. This plant is used by the Menteras in combination with Tuba. (*Derris elliptica.*)

The species of *Strychnos* are often troublesome to identify, as they flower as a rule very irregularly, and, owing to the height to which most species climb before flowering, are very difficult to collect. The foliage, too, is often very variable according to what part of the tree it is obtained from.

There are six species mentioned in the Flora of British India as natives of the Malay Peninsula, but I have met with several others apparently quite distinct from any of these, and from the Indian species.

COPTOSAPELTA FLAVESCENS, Korth. (*Rubiaceæ*).—Prual; a climber with opposite broadly lanceolate leaves and axillary bunches of white flowers very sweetly-scented, according to Wray, the bark of the roots is used. It is said not to be so strong as Antiaris, but quite capable of killing by itself. The plant occurs in Malacca, Penang, Perak and Pahang. I know nothing of its properties.

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TABERNÆMONTANA MALACCENSIS. Hook. fil. (*Apocynaceal*).—Perachit Prachek; a shrub usually of no great size with white flowers in corymbs and orange-coloured curved pods in pairs, containing seeds enclosed in a crimson aril; it is common in Singapore, Malacca and elsewhere. Perachit is mentioned as used in the manufacture of Ipoh poison by Newbold.

It is used by the Malays in native medicine, the leaves and sap for poulticing boils, and a decoction of the bark is also used for syphilis as is that of the allied *T. corymbosa*. The roots are said by them to be poisonous. Several others of the genus have poisonous properties as *T. dichotoma* of India, of which the seeds are said to be powerfully narcotic, producing delirium and other symptoms like Datura, while the bark and leaves are said to be purgative (Dictionary of the Economic Products of India) and *T. sphærocarpa*, Bl., of Java, which is stated to contain an alkaloid. (Lewin Die Pfeilgifte.)

PRISMATOMERIS ALBIDIFLORA, Thw. (*Rubiaceæ*) is used by the Menteras with the last mentioned plant under the name of Mundess. It is a shrub with white flowers, common in Singapore, Penang, and Sumatra. I do not know of its possessing any poisonous properties. The bark and roots are the part used.

LAPORTEA CRENULATA, Gaud.—This shrub or small tree belonging to *Urticaceæ* is used with the Antiaris poison under the name of Rumpei according to Vaughan Stevens. The common Malay name for it is Jelatang. It is a soft wooded tree or shrub of no great size, with more or less oblong leaves, the petiole and part of the leaf armed with short stinging hairs. It is known in India as the Devil nettle or Fever nettle on account of its violent urticating powers. The flowers are produced in axillary panicles and are small and usually purplish.

It is by no means common in the Peninsula, but occurs in Selangor, Perak, Penang and Pulau Tioman. It is however very widely distributed, occurring in India and all over the Malay Archipelago. No medicinal properties are attributed to it, and it is probably only added to the poison mixture because it is irritating, and therefore in the native mind must be suitable for making poison. The form in the Malay Peninsula appears to be not so irritating as that of India and the Malay islands, but it has been stated that the hairs only sting at certain times.

CNESMONE JAVANICA, Miq. (*Euphorbiaceæ*).—Jelatang Rusa; is a climber of no great size which is to be found in thickets and waste spots. It has a slender stem covered with stinging hairs, oblong cuspidate leaves with a serrate edge and cordate base, covered with hairs and about six inches long and two inches in width; the leaf stalk is from half to one and a-half inches long. The inflorescence is a raceme about two inches long axillary, the upper flowers male the lower ones female. The flowers are small and green. The capsule is three lobed, about half an inch long and covered with strong spiny hairs. It occurs in Perak, Pahang, Malacca, Penang, Kemaman and Kedah, as also in Java and other islands of the Archipelago.

Like *Laportea* it is very urticating, but not as virulent as that plant. No experiments have been made on the plant to show what the irritating poison in the hairs is, but like the *Laportea* it is probably added to the Ipoh poison. merely because it is known to be an irritating plant, though it is possible that it may increase the flow of blood to the wound, and aid to the absorption of the more deadly drugs.

EXCŒCARIA AGALLOCHA L. (*Euphorbiaceæ*).—Is a small or moderate sized tree with an intensely acrid milk. The leaves are glossy dark green, rather thick in texture and lanceolatein outline. The flowers are very small and borne in slender green catkins one or two inches in length, and are deliciously scented. The fruit is a small round capsule.

Dr. Lewin (*Die Pfeilgifte*) states that this plant is used in the composition of arrow poison. It is probably used only as an irritant to increase the rapidity of action.

The tree occurs on the banks of tidal rivers and sea-shores all through the East Indies from India to Australia.

DIOSCOREA DÆMONA, Roxb. (*Dioscoreaceæ*) Gadong.—This is one of the yams and possesses a tuber from which rises a tall glaucous somewhat thorny climbing stem. The leaves are trifoliate with large leaflets 3 to 8 or 9 inches long. The flowers very small and greenish white in spikes, unisexual, the spikes are panicled, and the panicle is often very long. The capsule is about two inches long, oblong three-angled and rather more woody than that of most species.

The tubers are ground and pounded up, and the juice squeezed out through a piece of cloth, and mixed with the Antiaris latex (Wray), or according to Vaughan Stevens they are cut up small and cooked for four hours in as little water as possible.

Mr. Wray found that the acid juice yielded a yellowish brown precipitate to a solution of iodine in iodide of potassium. The precipitate redissolved in sulphurous acid and evaporated yields long branching needle-like crystals which have an astringent taste like the juice and are possibly the poisonous principle. Schutte (Pharm. Zeit. fur Russ. XXXVI, 379) has examined the toxic alkaloid, Dioscorine, obtained from this plant and shows that on the animal organism it acts as a poison resembling picrotoxin. It is a paralysant of the nervous system but not a protoplasmic poison.

The Gadong is often to be seen growing near villages, but I have never seen it really wild. The Malays, as also the Sakais use the tubers for food, slicing them and washing them in running water for a long time to wash out the poisonous principle.

AMORPHOPHALLUS PRAINII, Hook. fil. (*Aroideæ*), Likir, Lokie, Begung.—The large tubers of this aroid are used in the same way as those of the Gadong. Like all of the genus the tuber throws up a single large leaf at a time. The leaf stalk attains often a great size nearly two inches through at the base and tapering upwards, it is smooth and green mottled with white and brown, the leaf blade is much dissected, dark green in colour, and is of large size. The flower spike appears after the fall of the leaf and is enclosed in a large funnel-shaped primrose yellow spathe shorter than the spadix and recurved above when fully developed; the lower part of the tube inside is of a deep maroon colour. The male and female flowers are separated on the spadix which is terminated by a large primrose yellow cone-shaped process. The whole inflorescence is about a foot high.

The plant is common in Penang, Selangor, Perak, Sumatra and elsewhere. The juice of the tubers is, according to Wray, acid and causes irritation to the skin, but he was unable to find any alkaloid in the juice, and states that the use of it consists in causing local irritation which hinders wounded animals from escaping before the poison has had time to act. The Begung mentioned by Vaughan Stevens appears, from a sketch of his, to be the same species of *Amorphophallus.* He says that the tubers must be used fresh or they rot, and they are pounded up with other ingredients and boiled for half an hour. The tubers of this as well as other species are eaten after being sliced and washed as in the case of Gadong, but apparently not often as they are said to have an irritating effect. One species of *Amorphophallus* I saw being cultivated in Kelantan like potatoes for food and others are cultivated in India and Japan.

EPIPREMNUM GIGANTEUM, Scott, "Ringut."—A large climbing aroid with oblong leathery leaves one or two feet long. Common all over the Peninsula.

According to Vaughan Stevens the fruit is used for mixing with the Ipoh. He says, however, that when it is dry it contains a dust which, if it enters the eyes produces blindness, and the Sakais fearing this seldom gather it. As in the case of many Aroids the liquid contained in the spathe of the flowers, is very irritating to the skin, and it is perhaps the poisonous principle utilized or it may be the raphides which abound in the spadix which produces the irritation.

Vaughan Stevens mentions also the use of the sap of "Berar Kijang" (*Alocasia denudata*, Engl.) a common terrestial Aroid, used by the Menteras for mixing with the Ipoh, and Horsfield mentions also a plant called Nampong, probably some species of *Homalomena* as being used.

GNETUM EDULE, Bl. (*Gnetaceæ*).—A large woody climber with dark green lanceolate opposite leaves rather finely nerved, four inches long and one across. The fruit is two inches long and ¾ inch thick elliptical in outline and with a rather rough brown cerky exterior and is borne on very short spikes, only two or three on the spike. I have collected or received it from Singapore, Pahang and Kemaman, but it does not seem to be common. The large brown fruits make it a very distinct species and it appears to be the plant figured by Rumphius (Herbarium Amboinense

V, plate 7). This is again described by Blume under the above name in Rumphia, but he adds to it the synonym of *Gn. scandens* of Roxburgh, quite a different plant.

From Mr. Vaughan Stevens I have received leaves and a sketch of the plant which he describes as used by the Sakais under the names of "Blay Merah" "Blay Kechil" or among the Panghans "Kenne.t," The bark is used in the Antiaris mixture. No species of the genus are known to possess any poisonous properties.

Several plants are also mentioned as being added to the Ipoh poison which apparently have no poisonous principles at all, but are mere irritants and probably act by causing a flow of blood to the wound and increasing the absorption of the poison, such are *Piper stylosum*, Miq., Blay Pendy (Vaughn Stevens), a low-growing erect pepper about a foot tall. *Alpinia Galanga* and *Zingiber Cassumunaar*, Black pepper (Lada hitam) and leeks and onions are also mentioned by Horsfield, and Newbold mentions the use of Arsenic (warangan) and lime juice. The former of these must be considered very doubtful, as it would probably have no effect at all, and could hardly be obtained by a Sakai living in the woods.

Sedudu, mentioned by Vaughan Stevens, is apparently an undescribed species of *Medinilla*. It is an epiphytic shrub, with opposite leaves lanceolate, acuminate and denticulate, with short petioles. The flowers are axillary, two or three together, and the fruit is semi-transparent and white "like a white currant." The roots are used fresh, as their poisonous qualities disappear when dry, according to the Panghans. The sketch and leaves I have from VAUGHAN STEVENS are hardly adequate to identify the plant, but it differs in many points from any other species of the genus which I have met with. Some of the *Medinillas* are acid, and allied plants often astringent, but I know of none with poisonous qualities. The name Sedudu (or Senduduk) is commonly applied to many of the *Melastomaceæ*. Two species of Rattan (*Dæmonorops* sp.) Rotan Riong and Rotan Butong are also used, the sap from the cane being added to the decoction, according to STEVENS, who also mentions plants called Bal, Grow (or Chow) Choichoi, Lendow and Garsung. The sketches and leaves I have of some of these are insufficient for identification. Newbold also mentions the "Chev," but possibly this should be "Ches," a Besisi name for Antiaris (Skeat).

OTHER MALAY POISONS.

DERRIS ELLIPTICA, Benth. (*Leguminosæ*).—"Tuba," a low-climbing plant, often cultivated for use as a fish-poison. It is usually cultivated as a prostrate plant, the branches being allowed to straggle about on the ground. The roots are the parts used in catching fish, generally with the aid of lime, being pounded and mixed with the lime and water and thrown into river or arm of the sea. It is propagated by cuttings and grows fairly rapidly. The poison is said also by Newbold to be mixed with Antiaris for

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the dart-poison by the Sakais, and it is also used in the same way by the Mentawei islanders (Lewin Pfeilgift, 131). Occasionally it is used criminally. A good account of the plant and its use was published by L. Wary, in the Pharmaceutical Journal (1892, p. 61). He extracted the poisonous resin to which he gave the name of Tubain, but this had already been experimented with by Greshoff* who had called it Derrid. A similar-poisonous resins occurs in many other Leguminous plants used for fish poisons and has been named timboine, nicouline and pachyrhizin, all of which Greshoff appears to consider the same principle in various conditions of purity. Pachyrhizin is obtained from the seeds of *Pachyrrhizus tuberosus*, the Yambean (Bengkunang or Sengkuang) commonly cultivated here for its edible tuberous root. There was recently a case of accidental poisoning, in Singapore, by the seeds of this plant.

One part of derrid in 350,000 parts of water according to Wray or one in five million parts of water according to Greshoff will kill fish in half an hour. The poison is according to Wray insoluble, and he states he has seen a fish eat a quantity without ill effects. However the decoction made by pounding the roots in water is not only rapidly fatal to fish when it comes in contact with the gills, but is speedily fatal to man when swallowed. The extract has long been used by the Chinese and other gardeners here as an insecticide, but of course it is unsafe to use it on vegetables eaten uncooked.

DATURA FASTUOSA (*Solanaceæ*), Kechubong.—A tall herb with large dentate leaves, and shown tubular flowers, white or more or less violet attaining a length of as much as seven inches but often smaller. The fruit is a globose thorny capsule about an inch through, dehiscing irregularly and containing a large number of flat seeds.

There are three varieties met with here; one with dark purple stems and single violet flowers the "Black Datura"; one with single white flowers and green stems, *var alba*, and one with double violet flowers. The plant is often cultivated and occurs as a common weed in many places, being indeed very difficult to eradicate. It grows rapidly and perishes after flowering. The plant is used by natives as an anodyne for sprains, rheumatism and boils, the leaves being applied to the injured part. In India it is smoked for asthma, and is a native remedy for hydrophobia. The native name here, Kechubong, is evidently a variant of Kechubu, an Arabic word given by Ainslie as a name for the plant.

Its action as a violent narcotic poison is well enough known, and it is stated that the black variety is the most poisonous. This variety is much the commonest here. Almost any part of the plant, flowers, leaves or seeds is used for poisoning.

D. Metel, L.—An allied species with pubescent leaves and stems and ten not five lobes to the corolla does not occur here, nor does *D. stramonium*, L. a smaller plant with white flowers.

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* Nuttige Indische Planten, part iii, 100.

CERBERA ODOLLAM, Gaertn, Buta-buta, Babuta (*Apocynaceæ*).—This tree is very common in tidal swamps. It never attains a very large size and is sometimes rather a large shrub than a tree. The leaves are oblong and dark green. The flowers in corymbs are white with a pink or yellow ring in the throat tubular ending in a star-shaped limb. The fruit is large and fleshy, somewhat of the shape of a Mango, but less flattened, green, usually more or less tinted with red and containing a large stone covered outside with a strong network of fibre.

The whole plant is full of milk-like latex, which is stated by the Malays to produce blindness when dropped into the eyes, whence the native name Buta-buta (blind).

De Vrij isolated a crystalline substance from the plant known as cerberin. It is a violent heart poison acting like digitalin and allied to the poisons Tanghinine (from the Madagascar ordeal Bean *Tanghinia*) and Thevetine (from *Thevetia*). Cerbera appears to have been used as a poison intentionally either for crime or suicide in India, but I do not know of its use here. Malays have told me that to stop for some time under a tree of it makes them ill, but this may be imaginary on their part. However they generally avoid it when possible.

GLORIOSA SUPERBA, L. (*Liliaceæ*).—A climbing plant, with very ornamental red and yellow flowers with erect spirally twisted petals, often cultivated as an ornamental plant, and half wild on the sea-coast. This has long had a reputation for being poisonous, but of late it has been stated to be innocuous. A case of fatal irritant poisoning due to this plant occurred lately in Singapore. Two Chinamen, having collected and boiled a quantity of the rhizomes and eaten them, were seized with a severe illness, of which one died.

RENGAS POISONS.

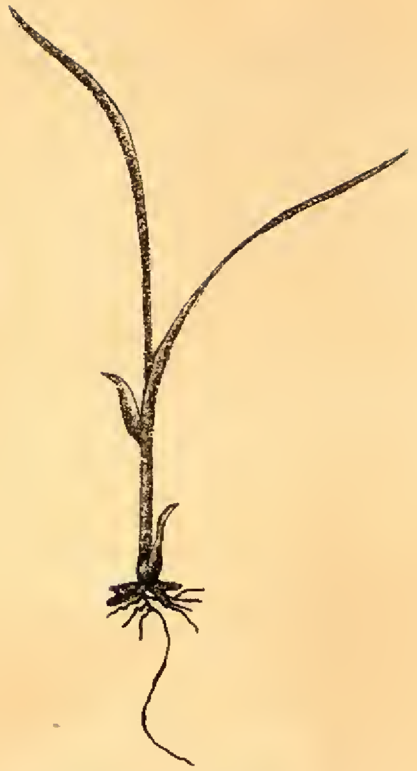
The name Rengas is given by Malays to a number of trees belonging to the order *Anacardiaceæ* which exude, when wounded, a black varnish which produces a serious irritation of the skin. Among them are the following: *Melannorhea Maingayi*, Hook. fil., *M. Curtisii*, Oliver., *Melanochyla auriculata*, Hook. fil., *Gluta Benghas*, L., *Gl. elegans*, Kurz and *Mangifera Kemanga*, Bl.—Nearly all the Malayan *Anacardiaceæ*, contain a quantity of similar resin, but as a rule, the others are comparatively harmless. An account of the effects of Rengas poisoning has been published by Dr. Brown in the Journal of the Straits Asiatic Society, No. 24, p. 83. The resin when it touches the skin even in very small quantities produces inflammation followed by a pustular eruption and often much swelling of the part affected, sometimes ending in the formation of ulcers. Internally Dr, Brown states that it acts as a violent irritant causing vomiting and purging and is very dangerous. There is no doubt that some persons are more sensitive to the external action of this poison than others, but nearly all are more or less affected by it, and I have seen natives seriously injured by what must have been very minute quantities of the milk. It is often stated that furniture made from the Rengas trees retain the property for a long time and affect the persons using it. Wood-cutters are the persons who naturally are most often injured by these trees, but they manage usually to avoid the action by rubbing themselves with coco-nut oil, which prevents the resin from touching the skin. Vaseline is the best application after injury from the resin. and Dr. Brown recommends the use also of bicarbonate of soda.

A very similar action on the skin is produced by *Caryota urens*, L. (*Palmæ*), a palm sometimes cultivated here and wild in some parts of the Peninsula. A boy who climbed on a tree suffered for some time from its action on the thighs, hands and arms.

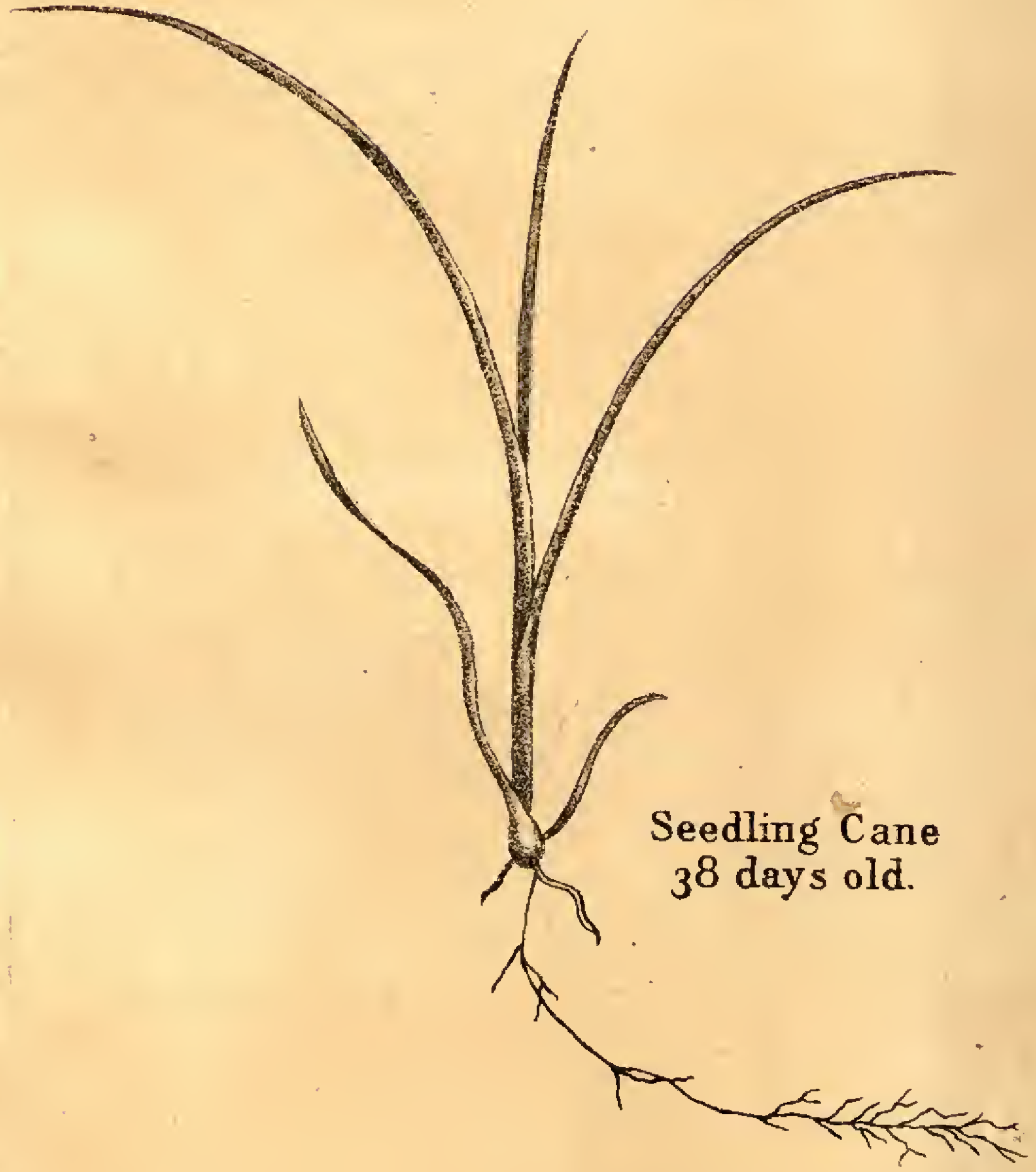
SUGAR-CANE FROM SEEDS IN THE STRAITS SETTLEMENTS.

Until about ten years ago it was supposed that the Sugar-cane had lost the power of producing fertile seeds, but that is now proved to be an error. During that period seedlings have been raised in Java, the West Indies, Mauritius, Kew, and probably elsewhere. It is said that canes were raised from seed by a gentleman in Barbadoes as far back as 1858, but little appears to be known of this, and the first successful attempt of which I have seen any authentic record is that of the late Dr. F. Soltwedel at the Experimental Station of Samarang, in Java. This was followed closely by Messrs. Harrison and Bovell's discovery at the Botanic Station, Dodds Reformatory, Barbadoes, of self-sown seedlings in the field, and also by their raising plants in the nursery. Opinions differ as to whether any great advantage will be gained by the use of seeds, but for my own part I cannot but think that seeing it opens up a much wider range of variations than had hitherto been possible, something of practical value will come of it if systematically followed up. At the beginning too much was expected all at once, and big prices were paid for seedlings, merely because they were seedlings, without waiting to see whether they showed any marked improvement on the parent or not.

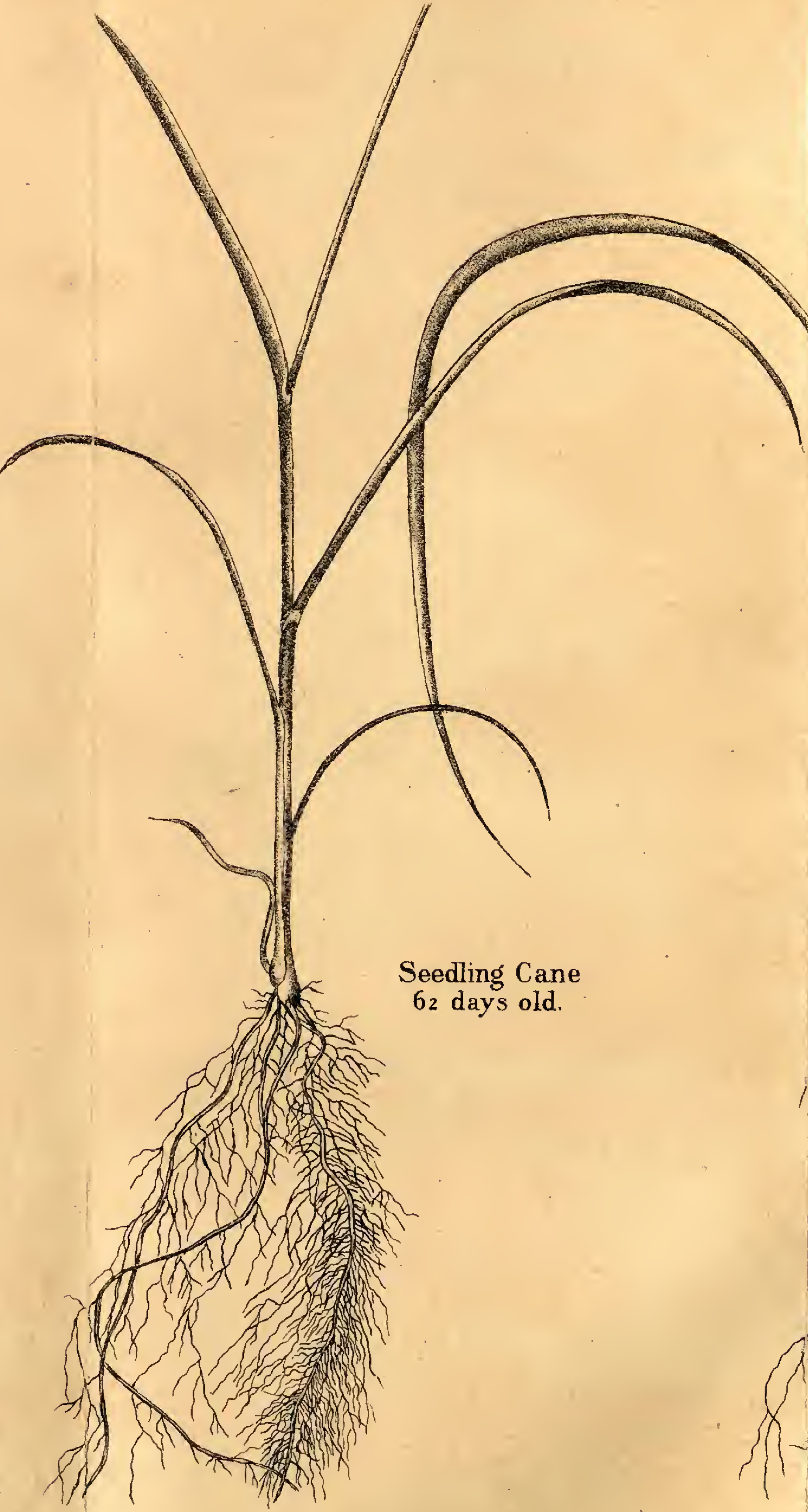
As in the case of other plants that have been brought to a high point of perfection by selection from seed, only a small proportion can be expected to be worth perpetuating, but by selecting these and seeding them again we may reasonably expect to attain the object in view. What this object is, is set forth in an article in the *Demerara Argosy*, for November 1st, 1890, and reprinted in the Kew Bulletin for January, 1891. In this the writer says:—"There are three possible ways in which we may look for improvement in the sugar-cane. We may obtain a variety that will give a larger weight of cane per acre, though it may contain no more sugar per ton of cane than the better kinds we possess now. Again, we may obtain a variety yielding a higher percentage of sugar though the weight of cane be not increased.



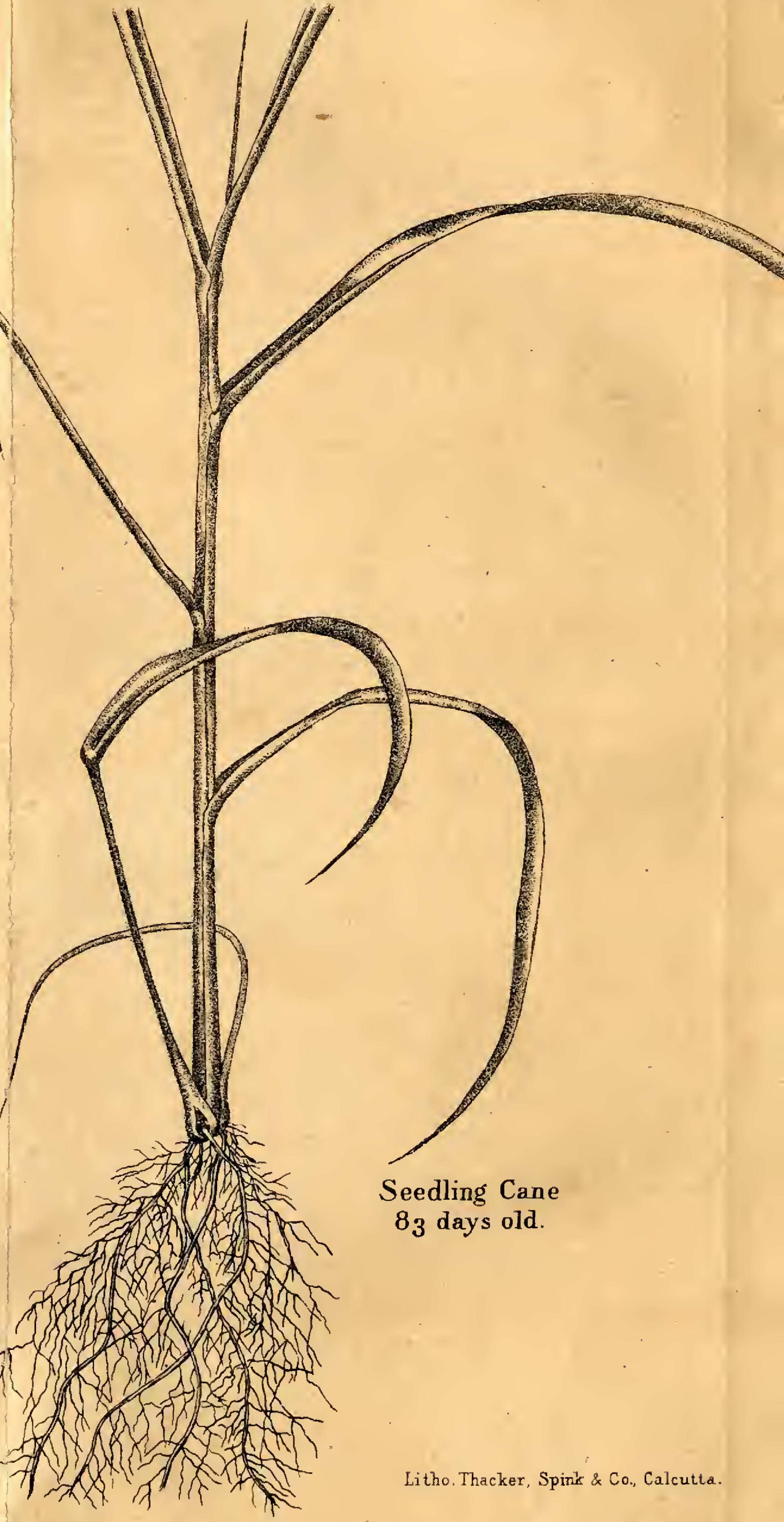
Seedling Cane
24 days old.



Seedling Cane
38 days old.



Seedling Cane
62 days old.



Seedling Cane
83 days old.

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Litho. Thacker, Spink & Co., Calcutta.

Thirdly, we may obtain a cane containing both increased yield of cane and of sugar.'' There are also other points to be taken into consideration in which selection may be of advantage, such as, capability for a particular soil or altitude, which will at once occur to the practical planter.

After two or three unsuccessful attempts we succeeded in November, 1896, in obtaining from Mr. E. A. B. Brown of Prye Estate, Province Wellesley, a bundle of arrows of the Borneo cane containing good seeds from which were grown about three thousand plants. Owing to want of suitable ground in the nurseries of the Botanic Garden in which to grow on such a large number, the greater portion, when about a foot high, were handed over to Mr. Brown, who supplied the seeds, and to Mr. J. Turner, the manager of the Pinang Sugar Estates Company.

Unfortunately the weather set in dry soon after Mr. Brown had planted his, and there being no facilities for watering, the greater portion died. Mr. Turner informs me that his are doing well, but I have not seen them for some time. Of those kept to plant in the Botanic Garden Nursery, about six hundred in all, the first portion of three hundred were planted on the 15th February, that is, when just three months and ten days old. These made rapid progress, and in August two thousand one hundred canes were taken from this lot by Messrs. Brown and Turner for further trial on their estates. Each cane would at this stage give three or four cuttings.

Fifty stools, showing, as far as can at present be judged, the greatest promise and widest extent of variation, were allowed to stand for the purpose of obtaining seeds, but up to the present time, and they are now nearly a year old, and from ten to fourteen feet high, they show no signs of flowering. There is greater variation in this batch of seedlings than would be obtained from accidental ''sports,'' or bud variation, on an estate of several thousand acres in many years. The ''Borneo'' is a purple cane, but the seedlings are of various colours, a good number being green ones. There is scarcely one that is exactly typical ''Borneo,'' although in the matter of foliage all bear evidence of their parentage. The second batch of three hundred were not planted until about six weeks after the first, and were not potted off, so they are not so far advanced, but otherwise look just as well in every way. I am told by the planters that the difference as regards height, and general appearance, between the first lot planted and a field planted in the ordinary way from cuttings at the time these seeds were sown, would be in favour of the cuttings by about two months only. Considering what delicate little things they are in the earlier stages, as will be seen by the accompanying sketches made at different times, the rapidity of growth is remarkable.

The seeds were sown in light sandy soil on the 4th November, some in pots, and some on a bed protected from sun and rain. One portion of the soil was in each case sterilized by boiling to

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make sure there were no grass seeds in it, but as cane seed germinates quickly there is no particular advantage to be gained by this. One portion was covered very lightly with a sprinkling of fine sand, and the others not at all. The advantage is slightly in favour of the former method, though it is not great. Each pot was covered with a piece of glass to prevent too rapid evaporation, and when the soil appeared to be getting dry the pot was plunged for a minute or two in a vessel with water up to the rim. No water was given overhead until the plants were a fortnight old.

Those sown in the bed were, however, watered with a fine rose pot from the first, as often as was necessary, and furnished a good number of plants, but not by any means in proportion to those sown in pots and covered with glass. The advantages are all in favour of the latter method. When a month old the young plants were pricked out in boxes four or five inches deep in a mixture of pure leaf-mould and sand in equal part and a sprinkling of bone dust added. This was passed through a quarter-inch sieve. At two months old three hundred plants were potted in five and seven-inch pots in a mixture similar to that used for the boxes, but with the addition of a little fine old cow manure.

If good seed is obtainable there appears to be no difficulty in raising any number of plants, but I think it should be sown as it is ripe. A second sowing from the same lot of seed from which these plants were raised, after an interval of fourteen days, and under exactly the same conditions, failed to produce a single plant. That this is not always the case is evident from the fact that canes were raised at Kew from seeds sent from Barbadoes. Those interested in this subject will find interesting papers in Kew Bulletins for December, 1888, October, 1889, January, 1891, and March, 1894.

C. CURTIS,

Penang.

SHADE TREES.

Suitable trees for shading roadsides and open spaces are not so easy to decide upon as would appear at first sight. They require several qualifications, in order to be satisfactory, and some which are adapted for one class of locality are quite unsuited for another. The trees selected should be at least fairly fast growers, but many trees of rapid growth must be condemned on account of their short life period, or the brittleness of their wood. This latter is of course very important, as during gales, boughs of brittle trees will be thrown down on carriages and passers by and cause accidents. In some trees the boughs die away even when large and remain attached to the tree in such a manner that they form a constant danger. This is especially the case with Fig trees, such as the Waringin. As a rule trees which produce few large boughs are safer than those which produce a number of smaller ones. Most of our native trees are evergreen, that is to say, that they do not shed their leaves all at once. In deciduous trees like the Indian Almond, *Terminalia catappa*, the leaves are shed several times a year, altogether making a troublesome litter. Small-leaved trees are, as a rule, preferable to large-leaved ones, not only because of their producing less litter, but also because the large leaves, when falling, are apt to startle excitable horses.

Certain trees are objectionable, because they throw off the rain to the outer ends of the boughs, so that it all falls upon the road in one spot, usually causing much trouble and expense in upkeep. These trees generally possess small leaves ending in a long point, which hang downwards, either normally or at least during rain. The water falling on any part of the tree runs from leaf to leaf downwards and outwards till it reaches the terminal leaves of the boughs and then falls to the ground. These are known as centrifugal trees. The Waringin (*Ficus benjamina*)is one of this class. In centripetal trees such as *Elæocarpus ganitrus*, the rain pours down the boughs towards the trunk, where it runs down in a stream, so that a tree of this kind does not injure the road in this way at all.

Fruit trees again are unsuitable as a rule, because they tempt natives to climb them and break the boughs.

Attention must also be paid to the roots of trees. In the Fig trees and other such trees, the roots are very copious, and not very deep, and have a habit of ploughing through the road and breaking it up. They also get into drains and pipes, choking them, and pushing their way into crevices in brick-work; sooner or later separate the bricks and destroy the structure. Trees whose roots are shallow are also more liable to be blown down in a gale than trees which root deep and take a good hold on the soil.

A good shade tree should have a straight bare stem for at least twelve feet from the ground, and a good spreading head of strong branches. Proper pruning will improve almost any tree in these respects, and though it is usually neglected utterly by persons in charge of roadside trees, it well repays the little trouble entailed in attending to it. Trees with strict erect branches, like the Glam (*Melaleuca leucadendron*) are in some cases very suitable, but unless the road to be shaded is narrow they do not give enough shade to be of much use.

TREATMENT OF SHADE TREES.

It is not enough to merely put trees into the ground at stated distances and leave them to take care of themselves and grow or not as they like. They must be properly looked after and cleaned and pruned in a proper manner or they will entail a great deal of further work. The distance that trees should be planted from each other differs with different kinds. Usually about thirty feet apart is the best distance, but if it is desired to shade a road speedily, quick-growing trees may be planted alternately with

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the permanent trees and cut out when the slower growing ones have grown tall enough to give the required shade.

The holes for the trees should be a foot and a half wide and of the same depth. The earth taken out should be mixed with cow-dung or other manure and replaced in the hole.

The trees should in most cases, at least near villages, be protected with bamboo or other guards to prevent injury by goats or cattle, which will otherwise destroy, or at least so hurt the tree, that it will never grow satisfactorily. It would indeed be preferable to prevent natives pasturing their animals along the roadsides altogether if possible.

As the tree grows the unnecessary boughs should be cut off. If it bifurcates low down it is best to cut off one of the shoots, and allow one only to grow. This should be done as young as possible, as it inflicts less injury upon the tree, and is also a less waste of wood, which would have gone into the main stem.

Pruning should be done with a sharp parang, and even in the case of large boughs with the saw. The ends of the boughs should be cut smooth. To break or hack a bough irregularly leaving a split irregular stump is most injurious as this end invariably dies, fungi and insects attack it, and the decay may penetrate from a single injury like this into the trunk and kill the tree. Which are the proper boughs to cut off can only be learnt by experience. Erect shoots parallel to the axis of the tree may always be removed except in the case of the few trees which have habitually erect or nearly erect trees, such as the Gelam tree.

Boughs which straggle too much, leaving the centre of the tree bare should be cut back so as to produce growth towards the centre. The object of all pruning should be rather to get a small number of large boughs than a great many small ones, as the tree is then of a better shape and produces less dead wood.

Some trees, like the *Poinciana*, have a tendency to throw out long straggling shoots which should be rigorously cut back. The Poinciana when at the height required may be heavily lopped, as it will then throw out shoots in such a way as to make a compact regular crown, and will flower far better than when left to grow anyhow.

If the tree throws out shoots from the base of the stem they should be cut off as soon as possible, as they only weaken the tree.

In cutting large boughs care must be taken to slope the cut end, so that water does not lodge there and set up decay, otherwise a hole may be formed which may penetrate into the main stem and break up the tree. This lodging of water and consequent destruction by decay is an additional reason for preventing trees from bifurcating low down. The Poinciana is peculiarly liable to destruction in this way. Earth, partly brought by insects, partly drifted into the fork, holds the rain which runs down the trunk, and a portion of the wood dies. Then fungi, termites and other insects continue the destruction till one of the branches is broken off leaving a decay hole which soon destroys the whole tree.

Injury to the tree in the form of tears or hacks in the bark must be avoided as the wounded portion is very liable to be attacked by fungi which injure or kill the tree. Many of our native trees are protected against this injury by possessing a milky or resinous juice which flows out when the bark is cut or torn, covering the wound and preventing the lodging of spores of fungi.

Parasites and epiphytes.—These are highly injurious, and should be rigorously cleared off. The worst parasites are the mistletoes (*Loranthi*) which growing on the boughs send their roots downwards into the wood, and entirely destroying the bough which soon falls. It is of little use to tear the plant off, as it will usually grow again; the bough must be cut off below the parasite.

The epiphytic plants are those which merely grow on the bark and do not penetrate the bough itself. Many are really quite harmless as they do not cover the boughs but only grow sporadically on them. Orchids for instance rarely injure a bough even if in large numbers.

The worst of the epiphytes is the little creeping fern *Drymoglossum piloselloides*, which is excessively common. It is easily recognised by its round flat vegetative fronds and erect narrow spore-bearing ones. It will often quite cover a bough which will eventually die and fall. Another objectionable plant is *Dischidia nummularia*, a creeping plant with little rounded fleshy leaves very close together, which on being broken will be found to exude a milky liquid.

The climbing and more or less parasitic fig trees, are also usually very injurious. Seeds are deposited by birds or bats in cracks in the bark and grow eventually so large that the roots of the fig wrap round the tree, and at last kill it. In some cases the fig becomes a tree itself and so replaces the one it has destroyed. But several common kinds never become trees at all, remaining as shrubs or climbers and dying with the tree upon which they have grown. The most objectionable is the very common *Ficus subulata* with curious oval leaves with long points and small orange figs. Trees again are sometimes killed by a fig seed lodging in a fork of the main stem, the roots as it grows penetrating into the centre of the wood.

Trees Ordinarily in Use as Shade Trees.

Tembusu (*Fagraea fragrans*). — This is always raised from seed and grows very readily. It is a fairly fast grower, and of very handsome appearance. It generally attains a height of about sixty feet in suitable localities. The crown does not spread much, but it gives a good shade. It has a habit of branching low down, good specimens on a lawn feathering to the ground. It therefore requires pruning for roadside purposes so as to make a tall bare stem. In pruning it should be cut with care so as not to leave bark wounds, as it is liable to attacks of fungi, especially a kind of Polyporus. I have also seen trees killed by a black slimy fungus, which destroyed the cambium layer, causing it to emit a very foul odour. The Tembusu prefers dry localities, and is not at all suited for wet spots. It is an evergreen, and the leaves remain on the tree a long time, so it produces but little litter, and being one of our hardest timbers the boughs are but rarely broken even by a gale, and it is very rarely blown down.

As an ornamental tree it is very suitable for lawns, for it is not only a very picturesque shape but its deep green compact foliage and masses of small yellow flowers followed by scarlet and orange berries makes it very attractive.

KRIAN, Jambu Ayer Laut, *Eugenia grandis.*—This is one of the commonest roadside trees, being easy to grow, and very rapid. It is grown from seed and attains a height of about forty feet. The leaves are rather large and make a good deal of litter, but are seldom shed in any great quantity so that it does not give any great amount of trouble. As a roadside tree it has been lately looked on with disfavour on account of its having a habit of dropping large boughs suddenly, and sometimes even large trees are blown over by gales. It is very liable to a disease which is apparently due to an obscure fungus. The bark cracks up usually near the base of the tree at first, and corky out-growths often appear beneath it. In many spots roots are emitted in short tufts. The disease creeps up the tree, the leaves fall off, and the tree dies. The disease most commonly occurs in damp spots, often all the trees along one road are more or less infected by it, though all do not die. I have never been able to find the fungus which apparently causes the disease. It is probable that this disease is the cause of the breaking off of boughs suddenly.

In a wild state, this tree as its second Malay name implies, inhabits the sea-coasts, growing in sandy spots, when it often attains a large size, and is apparently seldom attacked by the disease. For dry sandy spots it is an excellent roadside tree, growing rapidly, and affording a good shade, besides being very handsome from its bold dark green foliage and large terminal masses of white flowers. The wood is valued for boat building in many places.

ANGSANA, *Pterocarpus indicus.*—This is one of the finest of all shade trees. It will grow almost anywhere, but it especially suited for roads near the sea. It makes little litter and is strong and seldom breaks. Old trees attain a large size, and magnificent specimens may be seen in Malacca, Kuala Selangor and Penang. It is a deciduous tree shedding its leaves before flowering. It fruits readily and can be raised from seed, but it is usual to raise it from cuttings. These are made from old wood, about half an inch or more thick and about two feet long. As they break somewhat irregularly it is advisable to prune them to the form desired early. Seeds may be planted in beds, and only lightly covered with soil, the beds being shaded till the plants are well up. Seedling trees are usually of a better shape than cuttings, but are much slower in growth at first.

Saman, Rain tree, *Enterolobium Saman*.—A rather soft wooded tree raised from seed or cuttings. It grows very fast and is fairly long-lived, but being of irregular habit and being inclined to throw up suckers from the base, and long straggling boughs from the crown, it generally requires pruning to get it into a good shape. It makes a good deal of litter and often drops dead branches, but this fault can be improved by pruning out of the smaller ones.

Canary-nut, *Canarium commune*.—This handsome tree so largely used in Java and other of the Eastern islands as a shade tree does not thrive here. It suffers much from a boring caterpillar which kills the branches which then fall off, and in Singapore at least it grows slowly and attains no great size. It probably requires a better soil.

The Tamarind, *Tamarindus indicus*.—Is a very suitable tree near the sea coast, though it grows rather slowly even there. Inland it seems rarely to grow well, it is raised from seed, and forms a very handsome tree; being hard wooded, it does not readily break up and its small leaflets do not produce much litter. The tamarind fruits but little here as a rule, but further north, *e.g.*, Province Wellesley it generally crops pretty well.

Indian Almond, Ketapang, *Terminalia catappa*.—Is often used as a shade tree, being a fast grower, and seldom broken by winds. The great objection to it is the litter that it makes with its large leaves especially when its period of rest comes on, when it sheds all the leaves at once.

Spathodea campanulata.—Is well enough known as an ornamental tree. It is very readily grown from cuttings, as it never fruits here. It gives but little shade but may be alternated with denser trees for the sake of ornament. Though soft wooded it does not give much trouble by breaking up, and is not a dangerous tree in this respect. It is however liable to be blown down in gales. The habit of throwing up shoots from the roots even at some distance from the tree is sometimes troublesome.

Jacaranda mimosæfolia.—Is also a tree more suited as an ornamental tree than for shade. Its beautiful feathery foliage and showy violet flowers make it exceedingly attractive. It is raised from seed and grows fairly fast in most soils, but especially well in damp spots. It attains no great size and as a rule branches rather low down, and may very well be used for beautifying roads otherwise partially shaded.

Poinciana regia, the Flamboyant.—Is frequently used as a roadside tree on account of the beauty of its flowers. Its great defect is that it is comparatively short-lived, usually breaking up entirely in large pieces. The tree has a habit of rotting between the large branches, becoming partly hollow and then breaking up. It is however a rapid grower and is soon replaced. The tree is raised from seed and will stand a great deal of pruning which is often necessary to get it into a good shape.

STERCULIA ELATA.—A tree recently introduced from India, promises well as a roadside tree. It grows very fast and will stand lopping, and is moreover of good form. It is raised from seed and grows well almost anywhere so long as the soil is reasonably good.

PENAGA, *Calophyllum inopyyllum.*—Is a very handsome tree, easily raised from seed and growing fast, but owing to its habit of branching low down and forming but a short stem, it is not at all suited for a roadside tree. It also has the disadvantage of producing large quantities of hard, globular fruits which are most objectionable on the roads, being very likely to throw down horses. It is used, however, as a roadside tree in many places, especially in sandy spots near the sea where few other trees will grow well. It is but little liable to the attacks of parasites or epiphytes, and its wood is strong, so that it is seldom broken by wind.

There are a number of other species of *Calophyllum* here, but though they usually produce tall straight stems, they grow too slowly to be of use as roadside trees.

CASSIA FISTULA.—This magnificent tree called sometimes the Indian Laburnum, seems to grow best in the northern parts of the Peninsula, especially near the sea. The climate of Singapore does not seem to suit it at all, though there are a few fine trees to be seen there. It is more suitable as an ornamental tree from its beautiful masses of golden yellow flowers than as a shade tree, as it does not, as a rule, spread much. It is raised from seed and is a moderately fast grower.

C. NODOSA.—Is a handsome tree somewhat resembling the last with smaller leaflets and rosy flowers. It is a native of the Peninsula and in suitable places grows to a large size, with a spreading head of foliage. It is raised from seed and is a moderately fast grower.

C. JAVANICA.— Is a similar tree to the last with larger flowers borne on the ends of the branches, and not on the old wood as in the preceding species, and is altogether a more beautiful tree. It seems to grow more rapidly but not very tall. It is a native of Borneo and Java.

C. SIAMEA.—A smaller tree than the last three, with terminal trusses of golden yellow flowers, will grow readily almost anywhere. It is a very fast grower, but short-lived, and when it dies breaks up very quickly, so that though a very ornamental tree it is only suited for gardens and waste ground and not for the roadside.

SAGA, *Adenanthera pavonina* and *A. bicolor.*—Are fast growing trees suitable for alternating with slower growing ones, such as Angsana, and cutting out later. Among these, *A. bicolor* is the best, having much more compact habit, and its close small deep green leaves give it a very handsome appearance. *A pavonina* is of a much more straggling habit, and is not at all suitable for a permanent shade tree. It is much more liable to parasites and epiphytes than *A. bicolor*, however, itself possesses this defect in a large degree, and it is very liable to drop its branches. But for quickly shading ground, whether to improve the soil or shade other plants either are very satisfactory. The branches which fall are usually small and though objectionable on a road do no harm to coffee or other bushes beneath them. Their timber is soft and useless.

The two trees can be easily distinguished by their seeds which in *A. pavonina* are completely scarlet, in *A. bicolor* half black and half red.

ALBIZZIA MOLUCCANA.—Is a very well-known shade tree, growing very rapidly and attaining a great height. Its foliage is light and feathery so that it gives a very partial shade. It is not at all liable to parasites or epiphytes owing to its smooth to bark. The great defects it possesses are its liability to drop its large branches without any apparent reason, and the great distance to which its roots stretch. The roots are usually close to the surface, and throw up shoots at a considerable distance from the main stem. If the trees are planted too near the water-supply they taint the water especially during wet weather with a peculiar nauseous odour. The tree is generally raised from seed. It has long been in use as a shade tree for coffee.

WARINGIN, *Ficus benjamina.*—Some of the defects of this beautiful tree have already been alluded to. Its way of throwing the rain down from its pendulous branches upon one spot is most objectionable. Its boughs often fall, even large ones and more freqently smaller bits. Its roots run very far and penetrate into drains filling them up and disintegrating the brick work. It is also very liable to epiphytes, and to the attacks of a mistletoe (*Viscum*). Its rapid growth, easy handling, and beautiful form will, however, always make it popular. It can be raised from seed or cuttings. The seed is dispersed by birds and bats and young plants can be found in many spots, which are easily removed, and grow fast.

The PEEPUL, *Ficus religiousa.*—Is free from most of the defects of the Waringin, and if cut back constantly will form a beautiful tree especially suited for places near the sea. It seems to be long lived and is seldom injured by parasites or epiphytes nor does it spoil the roads by shedding the rain all in one spot like the Waringin. Its roots are however nearly as troublesome, and seedlings growing in brickwork where the seed is often deposited by birds soon breaks it up. It is a fast grower.

SENTOL, *Sandoricum indicum*, and Kechapi, *S. radiatum.*—Both very similar trees, are very suitable roadside trees. They grow fairly fast, straight and tall, are long-lived and seldom break, nor do they make much litter. They seem but little liable to parasites or epiphytes. They are well-known as fruit trees, though the fruit is poor, and not used by Europeans.

The Kechapi is distinguished easily from the Sentol by its downy leaves, which are, glabrous in the latter. Both are grown from seed.

MANGO, *Mangifera-indica.*—Needs only to be mentioned as a tree to be avoided as a shade tree. It is very liable to the attacks of a boring caterpillar and to other leaf-eating ones, so that it almost always looks shabby, and the boughs die and break off.

KURRIMIA PANICULATA is a very fine tree with large deep green leaves and possesses all the qualities suited for a roadside tree except that it is of very slow growth.

MIMUSOPS ELENGI, Poko Tanjong.—This tree grows very well along roadsides but it is rather a low tree, though bushy. It grows fast from seed and is a strong wooded tree, seldom attacked by parasites, and lasting long. Its deep green leaves and starry white sweet-scented flowers make it very attractive. It is better suited perhaps to shade narrow roads in gardens rather than main roads on account of its height.

CANANGA ODORATA, Kenanga.—Is a tall fast growing tree attaining a height of sixty feet, and usually possessing a clean straight stem. Though a somewhat soft-wooded tree it is not brittle and does not drop large branches, nor though its leaves are fairly large does it make much litter on the ground. It is especially suitable for damp ground, though it will readily grow almost anywhere. It is but little attacked by parasites nor owing to its smooth bark do epiphytic plants infest it. It has also the merit of having very sweet-scented flowers, which give a pleasing odour in the evening. It is readily raised from seed.

RU-TREE, *Casuarina equisetifolia*, Forst.—Though a popular tree is hardly suited for the roadside, being very liable to drop its branches and being very unsafe from this cause. It is raised from seed and is of rapid growth, but seldom grows really well except near the sea. In fact in the wild state it invariably grows along the seashore just above the beach and usually in a single line, never going further inland. It is seldom attacked by parasites or epiphytes, but the boughs often die away and fall in a gale.

PARA RUBBER NOTES.

Some planters seem to have experienced difficulty in germinating the seeds of the Para rubber satisfactorily. This appears to be due in some cases to their having planted them too deep in the ground. In the natural state the seeds are shot out of the capsule when it explores so violently that they are often embedded fully half in the mud if sufficiently soft, and they then begin to germinate. It is therefore not natural to cover them deeply with soil. They should be placed on the ground the flat surface downwards and pressed into the mud for about half their depth, or a little more. If covered, this should be done very lightly so that the mice which often eat them may not easily find them. One planter reports that snails attack and devour the shoots as the seeds germinate. Snails are not, as a rule, very common in the Peninsula, but in localities where they are abundant the seedlings should be protected against them.

Seeds vary very much in size and colour, and naturally when it is possible to select, large and dark coloured seeds should be taken. The reason for the difference in size and colouring is not clear. Some trees produce pale unhealthy looking seed which, however, germinate well and seem to be quite sound. Possibly this may be due to the trees being young, as large and old trees generally seem to bear large and dark coloured seed.

In packing seed for sending to a distance it is found best to pack in fine soil, or leaf mould, the seeds being placed in layers with mould beneath. Rotten leaves, with a little sand is also a good packing material. Coco-nut fibre dust or charcoal or any dry dusty substance are inadvisable as the seed suffers more from dryness than from damp. Recently some seeds were sent in a wooden box filled with a coco-nut fibre dust and rotten leaves. At the end of the voyage, about a fortnight, these were found to be nearly all germinating but the plumule was hardly showing in any of them. At the same time some of the seed was sent in Wardian cases planted in the earth of the pots inside the cases. In these cases it was found that the seed had far outstripped the others in growth having stems from four to six inches long, and showing the great superiority of this method of packing. Indeed this would be the best method for shipping seed for considerable distances except that it is very expensive as only one layer could be put in a Wardian case.

There seems to be a great diversity of opinion as to the duration of the germinating power of the seeds. It has been stated that after two or three days a large proportion of the seed may be expected to be dead, while after ten days none will germinate. This is certainly an error. Seed has been successfully sent from South America *viâ* England, though usually with much loss, and seed has been sent from Ceylon merely in gunny bags without any packing whatever, almost every one of which germinated. The fine trees in the Botanic Gardens in Singapore were nearly all sent in this way. Of course loose packing in gunny bags is not at all to be recommended, as in hot weather they would suffer much if accidentally put in the sun on the voyage, but this shows that the germinating power is not so soon lost as is often supposed.

Cuttings.—Are very easily made from branches about as thick as the little finger or at least not thinner than an ordinary pencil. Any thicker or thinner than this usually fail. The American method mentioned by travellers of planting in water with only the tops appearing does not prove very successful, not only being inconvenient, but owing to the irregularity of our rainfall, the water sometimes overflows the tops of the plants and at others is insufficient. Cuttings are sometimes very slow in starting, but grow fast enough when well rooted. They seem to travel with great ease, if kept damp, and can be sent considerable distances if packed in damp grass, even before they are struck. I have met with but few plants which either as cuttings or seedlings have so much vitality as Para rubber.

We have not yet gauged the full capability of rubber producing of these trees. One planter, it is stated has recently taken not less than seven pounds of rubber, from a ten year old tree, nor does the tree appear at all to be injured by this drain.

A circular dealing with rubber cultivation in Ceylon, has recently been published by the Director of the Botanic Garden there. Among other information we learn from it that "while the tree will grow at Peradeniya (elevation 1,576 feet) it suffers much from cold and grows very much more slowly than in the low country." I do not know of any experiments which have been made in the Peninsula as to the altitude at which Para rubber will grow successfully, but in any case the hill lands we possess are not, as a rule, suitable in the matter of soil for this plant, and we fortunately possess a very large area of plain country which is very well adapted for it.

" The area of land in Ceylon suitable for profitable rubber cultivation is comparatively small, possibly not more than 10,000 acres." The trees, however, in suitable soil,in Ceylon, grow apparently as fast there as here. In the Heneratgoda garden were 45 trees, about 30 feet apart. They were eleven years old, and the girth taken about ft. 5·6 above the ground. The largest tree was ft. 7·5 round, the smallest two feet.

Some experiments were made as to yield of rubber which showed that trees of about 2 feet mean girth gave in six weeks' tapping lbs. 5·17 , while a tree nearly 12 years old and 50½ inch in girth gave an average of 1½ ℔. per annum from its 12th to its 21st year, yielding 1 ℔. 12¾ oz. at twelve years, and 3 ℔s. 3 oz. in its 20th. This yield is really less than has been obtained in even younger trees in the Peninsula.

The circular is well worth reading by our rubber planters, who will, I think, agree that both the rapidity of growth of trees, yield of rubber, and probable return have been underestimated, at least for the Malay Peninsula.

LEMON GRASS OIL.

Lemon grass oil, distilled from the grass known as *Andropogon citratus*, was formerly one of the few peculiar Singapore products. Ceylon and Singapore held the market. Ceylon oil, however, says the *Chemist and Druggist*, has quite left the market, and little comes from Singapore. In January, there was a threatened famine of the oil in England, and prices would have risen very high had not unexpected supplies arrived from Cochin in Malabar. It is much to be regretted that an important manufacture like this should be lost to the Straits, and it is all the more remarkable since at the time that the product was commanding an unusually high price the Singapore supply was dwindling away. A few years ago Lemon grass oil was considered only fit for scenting the cheapest hair oils and soaps, and was priced at 1½*d*. to 1¾*d*. per oz., but it was discovered that it contains a larger proportion of citral (the odorous principal of oil of lemon) than any other oil, *viz*., 75 per cent., as against 7 per cent, in lemon oil, and it is now employed in the manufacture of Ionone or Artificial Violet. Lemon grass oil in 1896-1897 went up from 2½*d*. per oz. to 8*d*., and is now 10*d*. per oz. This high price has produced considerable adulteration, and it is pointed out that should lemon grass oil go say to 1-6 per oz. it would perhaps pay to make citral from geraniol, a body existing in oil of geranium and otto of roses. The export to London amounted to 3,000 cases, each case containing from 21 to 23 oz. so that the value of the export for the year taking an average was £1,443. There certainly seems room for more distillation of essential oils here. Citronella still holds a very fair price. Vetiver can easily be grown and should pay. Cajuputi, the common Gelam tree would need no cultivation, as Malacca could supply an unlimited quantity. Patchouli oil needs no recommendation, the dried leaves being now higher in price than usual, while Cananga, Ngai camphor (*Blumea balsamifera*), Basil and Champaca flowers would certainly be worth the attention of the distillers.

CITRONELLA OIL.

Since writing the above note on Lemon Grass Oil, an important paper on Citronella has appeared in the *Chemist and Druggist* of Nov. 12, 1898. Citronella oil is used almost wholly as a perfume for toilet soaps and the consumption is increasing every year. Ceylon exports this year 1,174,205 lbs. from an area of from 40 to 50 thousand acres. The grass grows on the hillsides and requires practically no attention until the harvests come round. There are two harvests—one in July and August, and the other in December to February. It is cut and bundled by women and taken to the distillery, a plan of which, very simple in structure, is given.

The still is worked by steam distillation, no water being added to the grass. An acre of grass produces in the summer time 36 to 44 oz., the winter harvest producing only one-fourth of this. The price in October for the oil was 11½*d*. per ℔. in London. Mr. Fritzsche, of Messrs. Schimmel & Co., who supplies this report, states that the cost of production in Ceylon does not amount to more than 1 cent per oz., and Messrs. Schimmel mention that a Citronella oil of exceedingly fine quality is now distilled in the Straits Settlements but there is little of it and Java is also embarking on the enterprise.

COFFEA STENOPHYLLA.

In the proceedings of the Agri-Horticultural Society of Madras for July, 1897, p. 118, are some reports on this plant by three experimenters in different parts of Madras. All agree that their trees are quite healthy and free from leaf-disease. At Calicut and Wynaad the trees are reported to have done well in the matter of growth, but the crop produced is remarkably small. At Yercand, however, at an altitude of 4,300 feet, the growth has been remarkably slow, although the trees were very liberally manured. In Singapore one cannot find any fault with the rapidity of growth, and, judging from all observations, it would appear to be best suited for the low country. Its cropping, however, is decidedly poor. Unfortunately there is no suitable ground for Coffee of any kind in the Economic Gardens here, and it remains to be seen whether it will do better in richer soil, say in Selangor. The fruit too is very small, averaging a smaller size than Arabian. It is hoped to give it a thorough trial in the Native States, and should it be induced to crop sufficiently heavily, we should then be in possession of a plant resembling Arabian Coffee in the flavour of its seed, but possessing the advantages of freedom from disease and suitability for lowland cultivation.

COFFEE BLIGHT.

The following correspondence has been transmitted through the Secretary of State for the Colonies, and as it may be interesting to Coffee planters is printed here:—

GRENADA,
December 4, 1897.

SIR,—I have the honour to transmit an extract from a letter I received on the 25th ultimo from Mr. G. Whitfield of this Colony, on the subject of the injury done here to Liberian Coffee by a scale insect, some of which on diseased leaves I enclose for examination and report. I am collecting specimens of this insect in all its stages for identification.

2. Heretofore Liberian Coffee has been looked upon as proof against any blight or insect attack. In view of its wide culture

in every part of the world it would be indeed a sad awakening to find the contrary.

3. In 1875 some trees of Liberian Coffee in its home, Liberia, were affected by the *Hemileia vastatrix*. The effect was similar to what is described by Mr. Whitfield Smith. As regards the trees here no extensive injury was experienced nor have I heard since of any loss from the like cause.

4. May I invite reference on this important matter to the Director Royal Gardens, Kew.

I have, &c.,
ALFRED MOLONEY,
Governor.

The Right Hon'ble
JOSEPH CHAMBERLAIN, M. P.

EXTRACT FROM A LETTER FROM MR. G. WHITFIELD SMITH TO THE GOVERNOR, DATED 24TH NOVEMBER, 1897.

I also forward some diseased Liberian Coffee leaves. As Your Excellency will observe, these are attacked by a scale insect. When I first noticed it, some months ago, it was very scattered and seemed to do little harm, but of late it has spread rapidly, and now seriously affects the health of the trees. It occurs on plants growing in the open as well as on those under shade and the trees attacked gradually lose their branches.

Hitherto, Liberian Coffee has been considered proof against insect pests, and I thought your Excellency would like to know of this, especially as there is a chance of the disease becoming a serious evil if it finds a suitable object of attack in the Liberian Coffee.

ROYAL GARDENS, KEW,
January 12, 1898.

SIR,—I have the honour to acknowledge the receipt of your letter of December 30, 27379-97, enclosing copy of a despatch from the Governor of the Windward Islands with specimens of diseased leaves of Liberian Coffee.

2. On examination here it was found that these leaves exhibited no trace of "Coffee-leaf disease" (*Hemileia vastatrix*) or of any other fungus.

3. I observed that in the 3rd paragraph of his despatch Sir ALFRED MOLONEY makes the following statement:—"In 1875 some trees of Liberian Coffee in its home—Liberia—were affected by the *Hemileia vastatrix*. The effect was similar to what is described by Mr. Whitfield Smith," *i.e.*, apparently to that exhibited by the diseased leaves accompanying the despatch.

4. As the matter is of great importance, I may say at once that the effect is not in the least similar. The Coffee-leaf disease is a fungus which speedily destroys the tissues of the leaf and

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causes it to fall prematurely. The Grenada Liberian Coffee on the other hand as Mr. Whitfield Smith correctly states, is "attacked by a scale insect." As a matter of fact two distinct kinds have been detected :—(1) The circular scale, *Aspidiotus articulatus* which is also found on the West Coast of Africa (Lagos); (2) the long narrow scale chiefly on the ribs of the leaves *Ischnaspia filiformis*, which is very common in the West Indies and is also found in England.

5. These scale insects, though no doubt injurious, are not to be compared for a moment as a source of danger to Coffee cultivation to the Coffee-leaf disease. You are aware that the progress and distribution throughout the world of this scourge to Coffee cultivation has been watched by Kew with assiduous care. Originating about 1869, in Ceylon, it spread to the Malayan Archipelago in 1876, to Fiji in 1879, to Mauritius in 1881, to Natal in 1884 (Kew Bulletin, 1893, p. 362), and to German East Africa in 1894. But as I stated in my letter of December 16, 1896, it is not known to exist in the West Africa Colonies. Added to this, Liberian Coffee is found to be only moderately affected by it. I cannot but think, therefore, that all probability is opposed to the correctness of Sir Alfred Moloney's statement that the disease existed in Liberia in 1875, as Eastern Africa was not affected till nearly ten years later. I should be glad to know on what precise evidence Sir Alfred Moloney bases it. If true, it seals the fate of Coffee cultivation on the West Coast and seriously imperils that in the New World.

6. I enclose a memorandum of the most approved method of treatment for dealing with scale insects.

I am, &c.,

W. T. THISELTON DYER.

C. P. LUCAS, Esq.,
Colonial Office,
Downing Street, S. W.

Mixture for destroying Scale-Insects.

Heat milk nearly to boiling point and mix with double the quantity of kerosene; stir briskly until a thick creamy liquid is obtained.

Dilute with ten times the quantity of water. Spray or apply with a brush, keeping the mixture constantly stirred.

Sour milk is as efficient as fresh.

If milk cannot be obtained, or if the mixture is required in large quantity, a strong soap emulsion may be used in its place.

Note on the Correspondence.

One may safely say that there is no planter here with any experience in Coffee, who has not seen scale on Liberian Coffee, especially in neglected trees or on poor soil. As a rule, I think the blight does not do much harm, as the trees speedily get rid of it, generally, if well manured and strengthened, though in a dying tree doubtless it hastens the death. Our experience here is that Liberian Coffee is very liable to insect attacks, as indeed almost every cultivated tree is, and a number of moth caterpillars, beetles, bugs, aphides and other insects have been described as attacking the plant.

Kerosene emulsion as recommended by the Director of Kew, is as convenient an insecticide as one can get, but I have found phenyl mixed with water peculiarly deadly to scale insects and especially cocci (white blight). It often happens that these *Hemiptera* are protected by a waxy coating which throws off any ordinary liquid before it has had time to penetrate to the animal's body. Phenyl acts on the waxy secretion and apparently dissolves it at once, and the unprotected animal dies. The phenyl, which is purchased in tins, is mixed with water and stirred till the liquid has the appearance of good milk.

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